PETROLEUM PROCESSING

including Petrochemical Processing Section

NOVEMBER 1954

All-Out Unionizing

1955 will bring "biggest ever" organizing campaign by OWIU in all segments of the oil industry—p. 1725

Smog Reducer Plus

How California Standard cuts vapor loss at loading racks plus controlling air pollution—p. 1731

Better Correlations?

For process design men—here are new correlations between ASTM and TBP distillation analyses —p. 1738

Little or No Air Tubing

An important reason for electronic controls—p. 1728

A McGRAW-HILL PUBLICATION

Sunset AT 3-BAR RANCH

Day after day through the years gas produced from oil wells on the 3-Bar Ranch in Andrews County, West Texas, will be gathered, compressed, processed, and reinjected into the producing formation — resulting in the production of many hundreds of thousands of barrels of otherwise unrecoverable crude oil, the extraction of millions of barrels of liquid hydrocarbons from the gas, and the availability for markets in future years of a large dry gas supply.

Hudson designed and constructed the plant in collaboration with Stanolind Oil and Gas Company. Stanolind operates the plant and shares in its ownership with Humble Oil and Refining Company, Champlin Refining Company, and the Superior Oil Company.

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ENGINEERING CORPORATION

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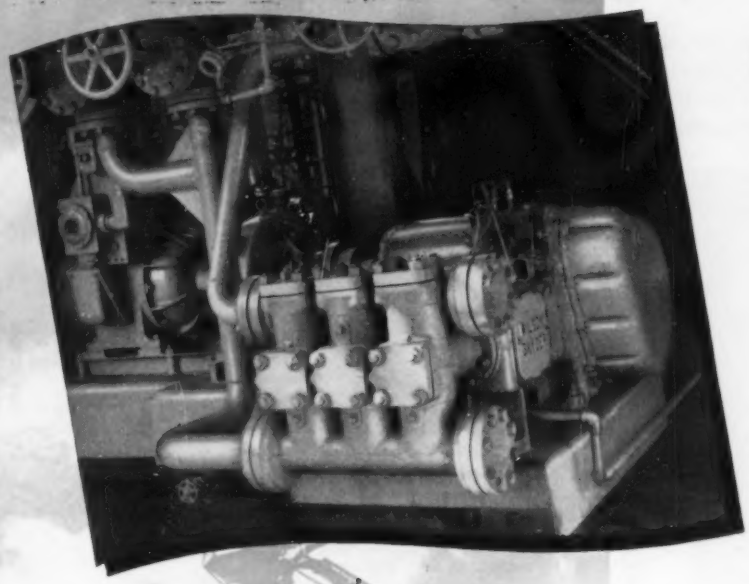
"This Wilson-Snyder Triplex Pump



is performing so well in Reactor Charge Service for our Platforming Unit at Grandfield, Oklahoma,

that we're using TWO MORE

—in our Ben Franklin Refinery at Ardmore!"

— says Dr. I. Arthur Anson
Vice President in Charge of Refining
Bell Oil and Gas Company

Bell Refinery, Grandfield, Oklahoma

—in Bell's Grandfield Refinery

. . . a Wilson-Snyder Triplex plunger pump, size 3¾" x 6", is the reactor charge pump for the U.O.P. designed platforming unit which went on stream in June, 1951.

This pump is equipped with hardened steel plungers (500 Brinell) and heat-treated and hardened drop-forged stainless steel valve service. It utilizes the output of a 50-hp. electric motor, through a gear reducer, to develop differential pressures of 800 to 900 p.s.i. through 4" intake and 3" discharge piping; handling hydrocarbons having a specific gravity of 0.67 at pumping temperatures of 275°F.

—in the Ben Franklin Refinery at Ardmore

. . . two more Wilson-Snyder pumps of the same size and type will be used in the new "cat" unit. One of these pumps will serve as the fresh feed pump—the other as a recycle and quench pump.

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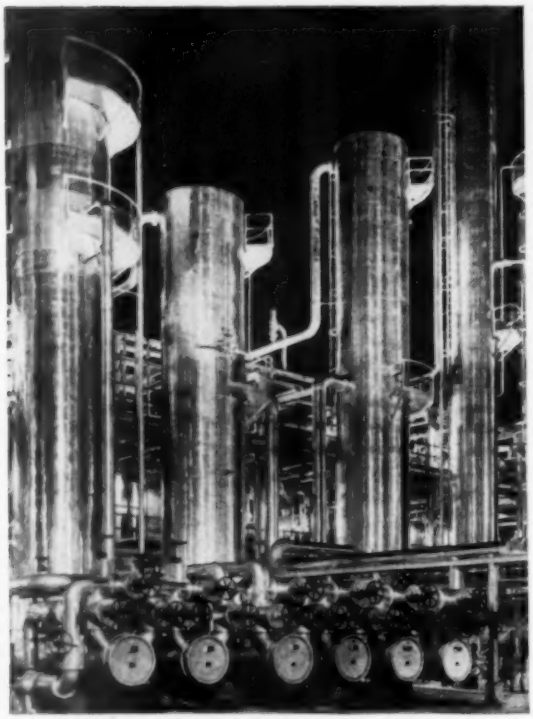

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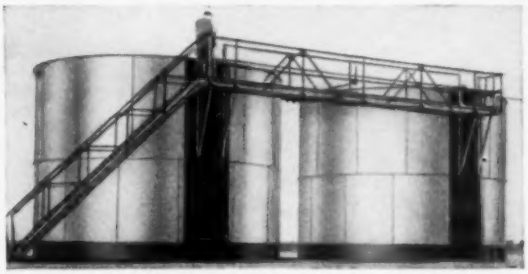

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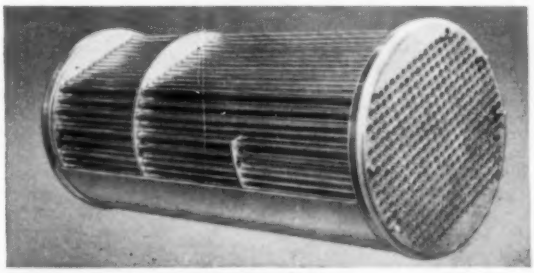

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MODERN DESIGN HAS ALUMINUM IN MIND

PETROLEUM PROCESSING

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals.

November, 1954
Vol. 9, No. 11

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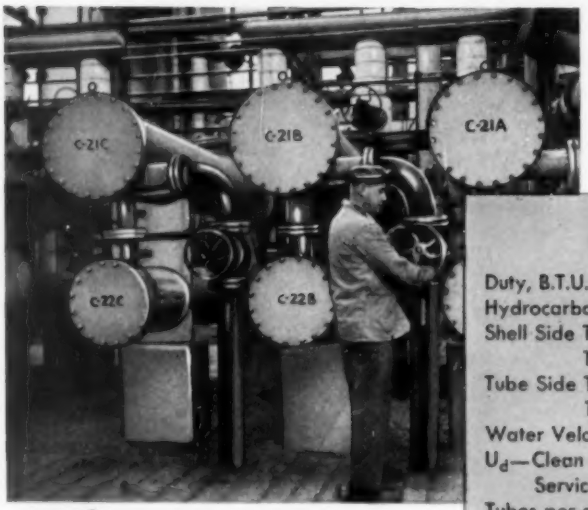
In Butylene Hydrocarbon Condensers

WOLVERINE TRUFIN*



THIS UNIT consisting of three Trufin condensers and three plain tube subcoolers—is installed at a large synthetic rubber plant.

More than Met Design Requirements

		BY OBSERVATION	
	Design	Condensing and Cooling*	Condensing Only
Duty, B.T.U. per hour	8,200,000	16,680,000	10,110,000
Hydrocarbon Flow, lbs/hr	56,800	99,700	69,500
Shell Side T-in	136°F	138°F	136°F
T-out	136°F	92°F	128°F
Tube Side T-in	70°F	49°F	69°F
T-out	120°F	110°F	125°F
Water Velocity, F.P.S.	5.6	9.4	6.2
U_d—Clean	188		
Service	106	156	155
Tubes per shell	292		
Tube length, feet	16		
Surface, Square Ft.	2120		
Tube Material	¾—90-10 Cupro-Nickel Trufin 195065-53		

NOTE: The condenser in this case is carrying all the subcooling load as well as condensing. The Trufin units have always done this without difficulty.

. . . and, as outlined in the data chart shown above, far exceeded the performance specified for this installation.

The unit was designed for condensing a minimum of 136,200 pounds per hour of vapor consisting of 90% butylene and 9% butane while using two of the three parallel circuits. Although each condenser was designed for a heat duty of 8,200,000 BTU's per hour, condensing loads as high as 16,680,000 BTU's per hour were noted in condensing and cooling operations. When condensing alone was handled, heat transfer achieved was 10,110,000 BTU's per hour—a substantial increase.

Factors contributing to this increase are Trufin's ability to withstand fouling (the shell sides of these units have never required cleaning), and the resulting increase in close control of transfer by control of water volocities. Also, Trufin with its increased surface area permits greater heat transfer to be packed into condensers. And because its fins are integral with the tube wall, Trufin never drops in efficiency because of fins loosened by vibration, high temperatures or pressure changes.

Insist on this kind of condenser performance, simply by specifying Wolverine Trufin. You'll find it available in copper, (its alloys), electric-welded steel, aluminum and bi-metal. For more information of how Trufin is setting new performance records, write today for your copy of the new Trufin Opportunity Book. WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan. 4067

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PETROLEUM PROCESSING

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Here's Another Staffer — Dave Thornton

THERE are two good reasons for introducing the fellow to the left—Dave Thornton. In the first place he's our Southwestern Editor, headquartered in our Houston office and working full-time on PETROLEUM PROCESSING, and I'd simply like you to know him better as one of my editorial associates. In the second place, he has just received a Certificate of Appreciation from the Petroleum Division of ASME for "outstanding service to the Engineering Profession and Petroleum Industry, as well as service to the ASME Petroleum Division."

Dave (D. P. Thornton, Jr., in the bylines) has been with us for 14 years—ever since he joined our Tulsa office as a reporter in 1940. Since then he's suffered birth pains on two new publications. He helped get out the very first issue of the old *NPN Technical Section* (our ancestor) in 1942. Later, he was in on the birth of PETROLEUM PROCESSING in 1946. He moved to Houston in 1950.

A native Oklahoman, Dave received his B.S. in Chem. Engrg. from Oklahoma A & M College in 1938, and worked for Refinery Supply Co. of Tulsa and Stanolind Oil and Gas Co. before coming with us. He's a member of ASME, AIChE and SAE, and a 32° Mason. On the home side, he's married and has one heir (Ross, circa 1940).

Dave is a typical engineer—he loves to play with gadgets. He even made his own power lawn mower long before they became a popular household item, by mounting an electric motor on the handle of his old-fashioned push model. He's an amateur photographer with a well-equipped darkroom, and for years has been fiddling with record players and recorders. One word of warning: don't get him started talking on those last two hobbies, unless you have lots of spare time.

The ASME award, presented to Dave during the recent Petroleum Mechanical Engineering Conference in Los Angeles, was in recognition of his services on the Division's Press Committee—as a member since it was formed in 1947, and as chairman in 1949 and 1952.

I know Dave is proud of his Certificate—and so are we. It emphasizes one of our cardinal philosophies—that a good technical editor should be an active participant in the affairs of his industry.

William F. Bland

Editor

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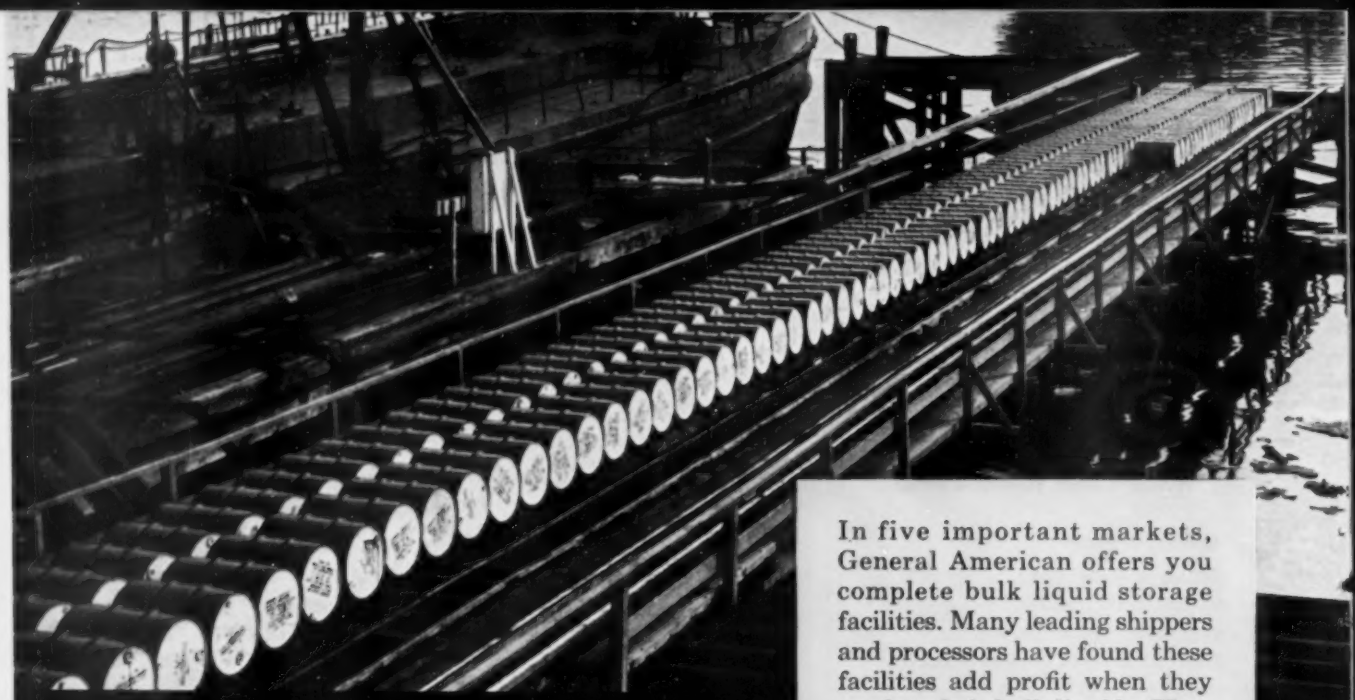

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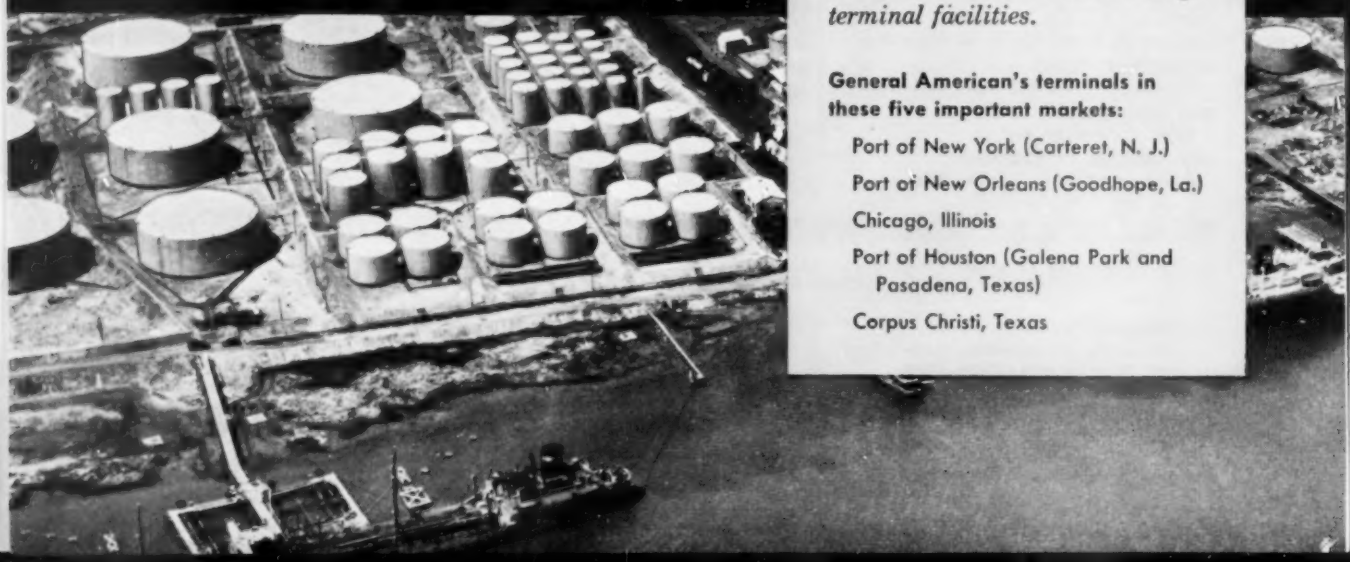


What's Happening...

in Refining

. . . **Expansion of present refining capacity** goal of 8,750,000 b/d by Jan. 1, 1956 will be sought, it is reported, from Office of Defense Mobilization by Interior Dept.'s Oil & Gas Division. Applications to date for rapid tax amortization will place capacity within 50,000 b/d of target.

. . . **New construction projects** approved for fast tax write-offs include the following:

Texas Butadiene & Chemical Corp., $29,599,000 for a plant at Settegast, Tex. (near Houston) to produce 5000 b/d of aviation alkylate from n-butane, including dehydrogenation, isomerization, alkylation units, as well as facilities to finish by-product butadiene.

Texas Natural Gasoline Corp. and H. W. Bass & Sons, Inc., $1,236,900 for addition to gathering system and process plant for increasing recovery of natural gas liquids, in Grayson and Cooke counties, Texas.

Texas Natural Gasoline Corp., $6,713,500 for gathering system and plant to process 60,000,000 cfd of gas, in Cooke county, Texas.

Esso Standard Oil Co., $6,990,000 for butane-propane splitter, polymerization unit, de-ethanizer and auxiliaries at Bayway, N. J., refinery.

Shell Oil Co., $1,186,500 for maintenance facilities at Wood River, Ill.

Humble Oil & Refining Co., $805,000 for refining units at Baytown, Texas.

. . . **Imperial Oil Co.** will install additional process equipment at its Ioco refinery (Vancouver, B. C.), mainly a catalytic polymerization unit and a naphtha fractionator, at a cost of $2,900,000. Contract will be awarded in November, with completion scheduled for October, 1955.

. . . **Union Oil Co. of California** plans to build a commercial oil shale plant near Rifle, Colo., according to A. C. Rubel, Union's vice president. Project cannot be started, however, for two or three years.

Statement was made as National Petroleum Council's Oil Shale Study Committee recommended Bureau of Mines end its oil shale experiments at Rifle, pointing out that at least four major oil companies are conducting their own oil shale experiments. Besides Union, Sinclair is known to be doing work of this type, and California Standard is reported ready to step in.

. . . **Ashland Oil & Refining Co.** has started construction of a new 6000 b/d Houdriformer at Catlesttburg, Ky. Completion is scheduled for mid-1955. Catalytic Construction Co. is contractor.

. . . **Socony-Vacuum Oil Co.,** has awarded Fluor Corp. contract to build a 20,000 b/d "Sovaformer" (catalytic reforming) and prefractionator at Paulsboro, N. J. with completion expected by July, 1955. An existing thermal reforming unit with gas recovery and treating facilities will be converted into the prefractionator.

. . . **Sun Oil Co.** is nearing completion at Marcus Hook, Penna., refinery of a unit employing a new process for lube oil treating that utilizes hydrogen and a catalyst. Described as the only plant of its kind in operation, the unit is said to be of low pressure type and having only one reactor. No further details were released.

. . . **Gulf Oil Corp.** will close its Sweetwater, Texas, refinery Nov. 21 for an indefinite period. Closing of this 8000 b/d design capacity plant—which has been operating at 6800 b/d—is third by Gulf this year. Ft. Worth, Texas, and Neville Island, Pa., are already closed. Gulf said Sweetwater is incapable of refining premium gasolines currently in demand.

. . . **The Chicago Corp.** of Fort Worth has contracted with M. W. Kellogg Co. to construct a 9000 b/d Model B Ortho-flow Fluid catalytic cracking unit at the Champlin refinery, Enid, Okla., with completion in 11½ months. Contract has also been made with Southwestern Engrg. Co. for construction of a 5000 b/d UOP Platformer, with completion scheduled in 7 months. Company is spending $4,000,000 on improvement program at Enid.

. . . **Stanolind Oil and Gas Co.** plans future addition of facilities at Midland Farms (near Odessa, Tex.) to increase plant capacity to 15,000,000 cfd. Midland Farms is a new plant, just put onstream with a capacity of 10,000,000 cfd. It is being run as a compression plant only, but additions will include absorption and distillation as well.

in Petrochemicals

. . . **Standard Oil Co. (Indiana) and Sinclair Refining Co.** have made a joint announcement of plans for a new 300 ton/day plant to make anhydrous ammonia. Plant will be built in Hammond, Ind., near Standard's Whiting refinery and Sinclair's East Chicago refinery, and will operate on by-product hydrogen and other gases fed by pipeline.

A new company will be formed to own the plant. Standard, which will supervise construction and later operate the plant, under contract to the new firm, is obtaining bids from contractors. Target date for completion and initial operation is early in 1956. Plant will also be able to produce ammonia and ammonium nitrate solutions.

. . . **Sun Oil Co.** will add a $9,000,000 anhydrous ammonia plant to its Marcus Hook, Pa., petrochemical facilities. Unit will have a capacity of 300 ton/day, using by-product hydrogen from cat reformers at the refinery. Completion is scheduled late in 1955. Unlike

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

most new ammonia plants, with products planned for agricultural uses, about 75% of Sun's production will be used for industrial purposes. Catalytic Construction Co. has the design, engineering, and construction contract.

. . . **Mississippi Chemical Corp.'s** Yazoo City, Miss., ammonia production capacity will rise from 120 to 290 ton/day when current three expansion projects are completed; one is already finished and two others are under way. All of the increased output will be used as fertilizers.

. . . **Rapid tax write-off program for ammonia storage** facilities is being sought from Office of Defense Mobilization by several petrochemical producers. Similar program for oil storage is being cited as precedent for establishing the ammonia program.

. . . **Newport Industries, Inc.,** has added a Hygirtol hydrogen plant to its facilities at Pensacola, Fla., in which the hydrogen is produced by catalytic steam-reforming of natural gas. Unit was designed and built by the Girdler Co.

. . . **Mobay Chemical Co.** will build the first full-scale plant in U. S. for producing isocyanate chemicals near New Martinsville, W. Va., with completion scheduled in about 15 months. Capacity will be "several hundred tons per month" and equivalent amount of polyester resins. Mobay is recently-formed, under joint ownership by Monsanto Chemical Co. and Farbenfabriken Bayer A. G.

. . . **Commercial Solvents Corp.** has awarded construction contract to Ford, Bacon and Davis Construction Corp. for its $5,000,000 nitroparaffin plant at Sterlington, La., with completion set for August, 1955.

. . . **Shell Oil Co. of Canada** is increasing the capacity of its Jumping Pound, Alta., natural gas plant from 35 to 60,000,000 cfd of sales gas, with the result sulfur capacity will rise from 30 to 80 ton/day. Completion is planned for late fall. Refinery Engrg. Ltd. has contract on gas plant: R. M. Parsons Co. of Canada is building sulfur unit additions.

in Foreign Operations

. . . **Royal Dutch/Shell Group** plans two new catalytic cracking units, at total cost of about $56,000,000, and completion in late 1957 or early 1958. One, a 35,000 b/d unit is at Cardon, Venezuela, for Compania Shell de Venezuela, and other is at Curacao, Netherlands Antilles, for N. Y. Curacaosehe Petroleum Industrie Maatschappij.

. . . **Shell Petroleum Co.** is building a new 320 b/d unit for butane-propane production at the Shellhaven refinery in Essex, England. It is expected to reach completion in 1956, and will cost $840,000.

. . . **Recent plant completions outside U. S.** include the following:

Empresa Nacional de Petroleo, 20,000 b/d refinery at Concon, 8 miles from Valparaiso, Chile.

Raffinage de Petrole: 3600 b/d Houdriflow catalytic cracking unit at Antwerp, Belgium, refinery of Albatros S. S. Belge.

Swedish Shell: 20,000 ton/yr. lube oil plant at Stockholm, Sweden.

Anglo-Iranian Oil Co., has completed expansion at its Grangemouth, England, refinery, which now has capacity of about 55,000 b/d.

in Markets and Prices

. . . **Distillate fuels were quoted higher** at most points in the east, south, and southeast during October. But, wholesale gasoline prices remained easy. Retail gasoline price wars, too, continued over much of the country.

. . . **On Williston crudes,** Stanolind Oil Purchasing Co. posted $2.50/bbl. for production in Beaver Lodge and Tioga fields, and was immediately charged with "discrimination" by Amerada Petroleum, largest producer in the area. The $2.50 posting compares with $2.90 for top-gravity Mid-Continent crude.

. . . **Other price activity included** the following: Reduction of 0.5¢ in avgas tank car prices at East Coast and Gulf Coast points . . . Higher propane prices in the southwest . . . Slight increases in distillate cargo prices at the Gulf Coast . . . Increases in residual prices in the north and midwest . . . and reductions in tank wagon gasoline prices in the upper Great Lakes Pipe Line territory.

Although distillate prices were hiked at many points, some suppliers were worried about climbing stocks. But, most figured their inventory worries were temporary, believing the first cold spell would go a long way toward solving them.

. . . **Gasoline, on the other hand,** was still the big problem for many refiners. There was 13,000,000 bbl. in inventory over and above a year ago, and it was open season on new business. All through the midwest, over much of the states of Texas and New Jersey, at Boston, Hartford, Houston, Miami, and Whichita—"discounts" to move the gasoline were the order of the day.

in Transition

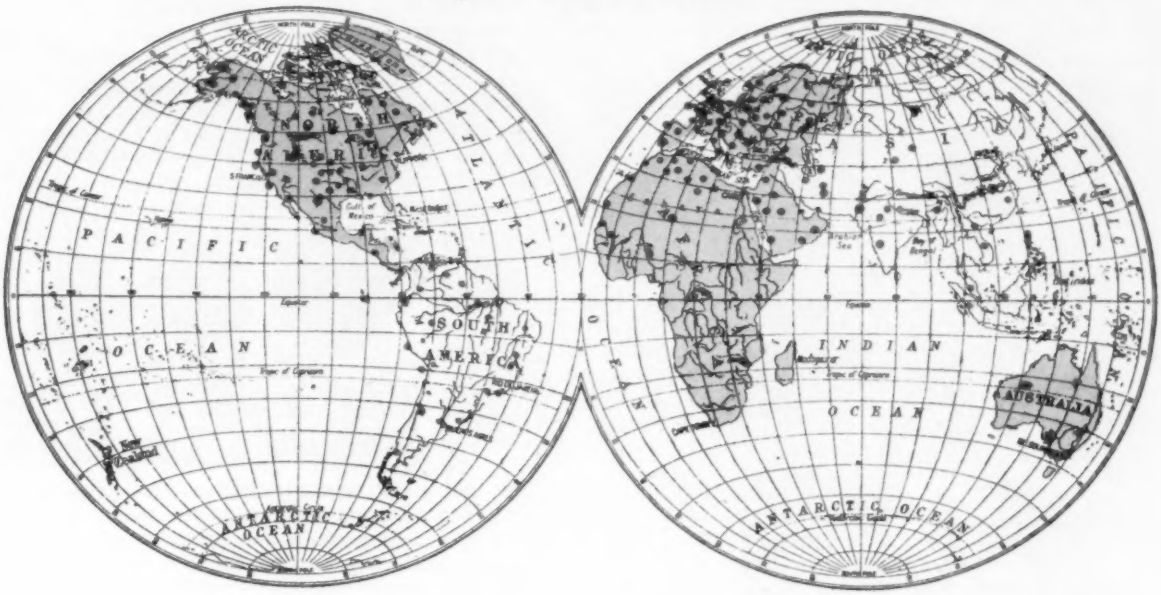
. . . **Midwest Refineries, Inc.,** has taken an option to buy controlling interest in common stock of Roosevelt Oil & Refining Co. Merger would mean a combined total corporate worth of over $7,250,000 and combined refining capacity of 17,500 b/d.

. . . **Sinclair Refining Co.** has introduced a new premium grade motor gasoline containing "MHM" compound, described as monohydroxymethane, and identified by a company spokesman as methanol.

LUMMUS

designs, engineers and constructs petroleum and chemical plants

scope: world-wide



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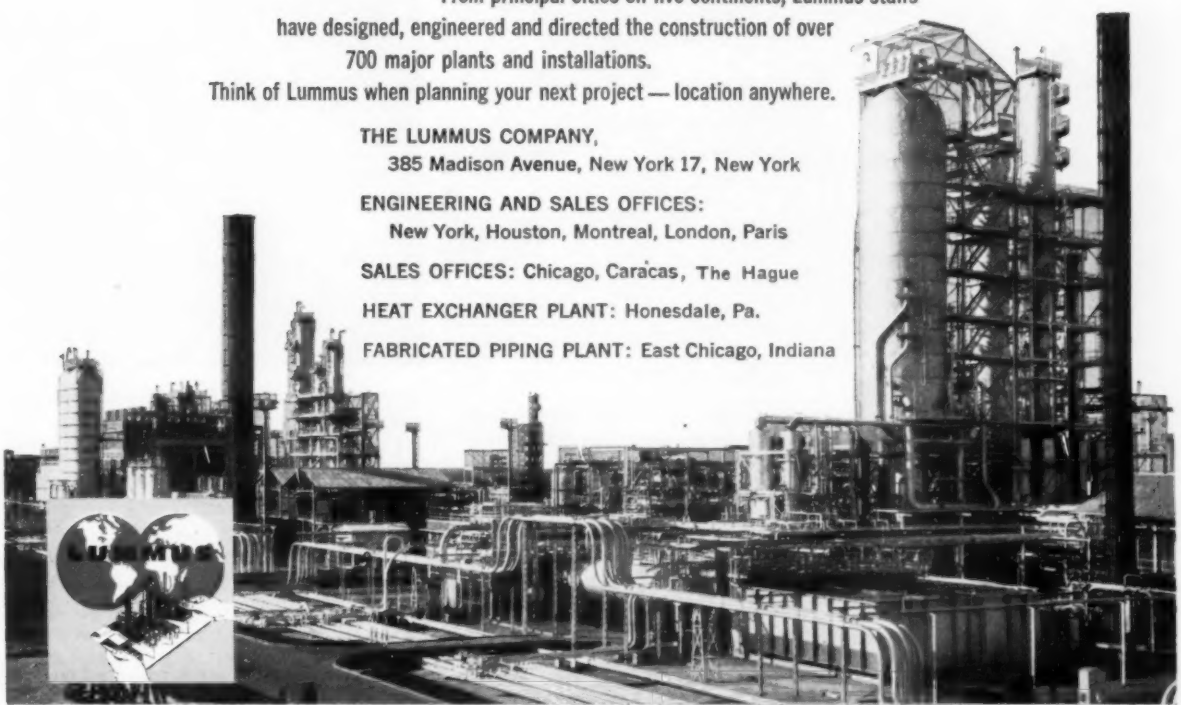

ILLUSTRATED: 40,000 B/D petroleum refinery at Dunkirk, France, designed, engineered and constructed by Lummus for the Societe Generale des Huiles de Petrol

America's leading refineries

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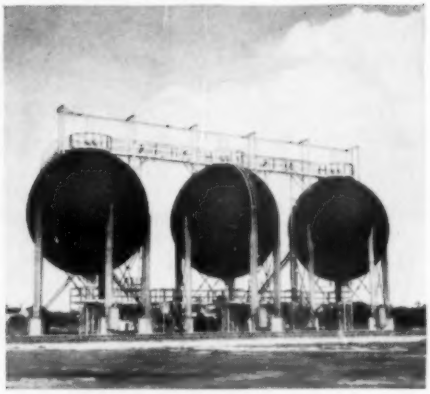
Continuing to serve America's refineries, GRAVER constructed the huge fractionator tower shown in the foreground for the new Mandan refinery of Standard Oil of Indiana. Reaching 120 ft. into the sky, it evidences the craftsmanship and experienced ability typical of Graver work.



GRAVERSPHERES are finding greater use than ever before with the tremendous growth of the refining and petrochemical industries. Ideally suited for high-pressure storage, they conform to Graver's exacting standards and are available in capacities ranging from 500 to 20,000 bbl.

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Atom Power for Mobile Use Has Promise but Needs Safe Packaging

ENOUGH has been reported on the development of means to harness atomic energy to show the great progress that has been made with stationary type power plants. Research with mobile reactors to date, on the other hand, has been almost exclusively for military purposes. However, something of the work in this field is discussed in general terms in a paper given recently before the Metropolitan (New York) section of the Society of Automotive Engineers.(1)

If atomic power plants can be made to work in ships, planes and perhaps even automotive ground equipment, this might sometime provide a strong competitor for the Diesel fuel, heavy fuel oil and even the motor gasoline markets the oil companies now supply.

Just how strong this competition might be can be seen from a comparison of uranium with chemical fuels given in the same report. Whereas the heat content of Diesel fuel and gasoline is 14,000 and 18,000 Btu/lb., respectively, that of uranium 235 runs to the astronomical figure of 40,000,000,000 Btu/lb.

In order to consider atomic reactors for mobile applications, the author brings out, it has been found necessary to think in terms of smaller sizes and higher temperatures than with stationary atomic power plants. Despite these limitations researchers have been able to develop designs compact enough for mobile installations, as has been done in the atom powered submarine Nautilus. Another authority reports that the Nautilus, from a piece of fuel the size of a golf ball (two pounds), extracts the energy equivalent to 460,000 gallons of fuel oil or 3000 tons of coal. Work is also under way to develop a nuclear powered airplane but none of the details have yet been disclosed.

The need for shielding operators from the radiation leaking from a reactor is a greater problem in mobile applications than with stationary power plants because of the overall weight and size limitations for mobile installations. "Fortunately for us," the report states, the thickness of the shield necessary to reduce radiation from a reactor is not proportional to the strength of that source. Instead, it is proportional only to the logarithm of the strength. If it were not for this, it would be impossible to contemplate even stationary reactors, let alone the mobile reactors. As it is, even the mobile reactors become possible.

Although the current state of the art restricts atomic power plants to larger size vehicles, the author believes that, as research improves our knowledge of shielding, the performance and economics of mobile atomic power should make it attractive for commercial applications. "The atom powered automobile is not yet in sight because it takes as much shielding for 75 hp on the ground as it does for 75 hp. in the air, and a 50,000-lb. automobile isn't very attractive." With an automotive atom power plant, it would also be necessary to provide protection from radiation leaks in case of a collision of vehicles.

Since the fissionable materials hold such a tremendous advantage over petroleum fuels in their latent heat energy, the safe harnessing of atomic power, to replace petroleum, is a goal that will keep many scientists and inventors awake nights. With its own experience in rapid technological development, the oil industry will probably be the last to say it can't be done.—V. B. G.

(1) "Atomic Power Vehicles", Kenneth Kasschau, Manager Atomic Energy Dept., American Locomotive Co.; before Metropolitan Section, Society of Automotive Engineers, New York Sept. 16, 1954.

New High Pressure Processes Spur Study of Pressure-Vessel Design

ADVANCING market requirements and new processing methods are forcing theoretical designers to push into the hitherto neglected field of high pressure, high temperature equipment design.

While adequate for low and medium pressure processes, the present American Society of Mechanical Engineers Pressure Vessel Code does not cover the region above 3000 psi and 1500° F. Even within these ranges, high pressure process design must combat corrosion, temperature and pressure cycling, erosion, differential expansion, hydrogen penetration, creep, and a host of other problems often not covered by the codes. Also the growth of equipment size and the limitations of railroad transportation will require partial field fabrication and erection with consequent difficulties in testing and stress relief.

The fault lies not so much with present pressure vessel codes, as far as they go, but with a lack of fundamental knowledge of crystalline structures and properties necessary to extend this code for high pressure applications. Some progress is being made in the solution of problems of brittle fracture, graphitization, and hydrogen blistering of steels. However more basic concepts under study have yet to be applied commercially.

Fundamental studies in solid-state physics are now in progress to determine the relation of trace impurities to physical properties. Dislocations, slips and plastic flow in crystals under stress are being investigated to understand the nature of material failures. More accurate and rapid material creep tests are anticipated from crystalline creep mechanisms now under study.

If the 1957-58 prediction of 98 octane gasoline and auto engines having 10:1 compression ratios materializes, the petroleum industry will require more catalytic cracking units using large pressure vessels and more catalytic reforming plants handling sizable quantities of hydrogen. Increased activity in processing plant design and construction will be required for the reduction of fuel-oil surpluses, the increase of aviation gasoline capacity, and the production of better lube oils. The petrochemical industry, now producing 50% of all organics made, will have its share of new construction activity. Production of synthetic fuels from hydrogen at high pressures and temperatures presents severe design problems which must be solved.

Process plant design engineers can expect continued

fundamental study aimed at the development of the larger high pressure equipment that will be needed for tomorrow's petroleum and petrochemical plants.

—R.L.D.

"A Look Ahead in Pressure-Vessel Design in the Petroleum Industry," E. W. Jacobson, Gulf Research and Development Co., presented at the Petroleum Mechanical Engineering Conference, Petroleum Division of the American Society of Mechanical Engineers, Los Angeles, Calif., Sept. 26-29, 1954.

Multiple Layer Pressure Vessels Give Processor Helpful New Tool

MULTI-LAYER vessels now can be built in commercial sizes for pressures up to 30,000 psi. for the larger sizes, and even higher pressures for smaller types. Such vessels have already been fabricated for working pressures of up to 20,000 psi. and have withstood 30,000 psi. Ammonia synthesis converters, for example, have been designed for 12,500 and 15,000 psi. in diameters of 25 in., thicknesses of 10 in., and lengths of about 45 ft.(1)

What does this mean to the petroleum processor? Oil refineries have not been concerned with processes involving pressures of such magnitude in the past. But, with ventures into petrochemicals becoming more common, and the likelihood of such processes as hydrogenation to upgrade plant stocks anything but far-fetched; indications are that refiners will become more and more interested in high-pressure equipment. Hence the construction of these super vessels becomes of interest.

Briefly, a multi-layer vessel is a shell of thin material—one-quarter to one-half inch—around which is mechanically wrapped the necessary layers of reinforcing material.

Each layer is butt-welded and the weld ground smooth before the next layer is added. And the longitudinal seam welds are staggered with respect to one another. The vessels are not stress-relieved, and thus cannot bear the ASME-Code stamp, although they are otherwise in conformity with its requirements as much as possible.

Three advantages are cited for this type of construction over the conventional high pressure vessel:

1—Only the inner layer need be selected to resist attack by process fluids, and it may be clad-plate: this is the only portion which is pressure-tight.

2—The load-carrying material is selected from high-strength formulations and is self-venting: if a leak develops, the resulting "weep" will warn the operator before the situation becomes dangerous. And the outer layers carrying the load will not be subject to hydrogen embrittlement.

3—The vessel is thinner-walled than one constructed of solid plate. There is no transmission of shear from one layer to the next, and size is not limited by the ingot as it is in forging. Development of high-strength materials for the outer walls now permits a reduction of up to 60% in wall thickness over that formerly used.

Tests of these vessels indicate they do not fail suddenly. One was fabricated of a high-tensile, high yield strength, low-alloy steel having a minimum ultimate strength of 105,000 psi., minimum yield strength of 70,000 psi., and 22% minimum elongation.

The vessel was 20 in. I.D. by 4.375-in. wall, and 10 ft., tangent-to-tangent, with hemispherical forged heads. It failed at 44,150 psi., the fracture indicating nonshatterability and the fact that the layers failed progressively. At the point of failure, the pressure dropped within 10 seconds to 42,800 psi. Pumping was continued, but began to increase 10 minutes later: the vessle burst at 42,850 psi., suddenly releasing 15,000,000 ft-lbs. of energy.

The future would seem to be open—on the equipment side of the picture at least—for just about any high pressure processes that oil industry researchers may have up their sleeves. —D.P.T.

(1) Fratcher, G. E., "The Influence of High Strength Materials on the Design and Fabrication of Layer Vessels," presented before Petroleum Division Conference, American Society of Mechanical Engineers, Los Angeles, Sept. 28, 1954.

Fluid Coke Can Compete for Fuel And Metallurgical Coke Markets

A NEW market of almost unlimited proportions is being developed as the result of the increasing need to reduce crude residuum production. Standard Oil Development Co.'s new Fluid coking process produces a coke so different from present day petroleum coke, that considerable study has been made to determine its potential uses.

Fluid coke consists of rounded particles about 20 to 100 mesh, is hard and resistant to attrition, can be ground satisfactorily, pours and flows easily, and is clean compared to most carbonaceous materials. The carbon content is generally 90% and volatile matter 5% measured at 950° C. Having a high ignition temperature—burns easily at 1100 to 1200° F.—fluid coke does not give problems with respect to firing or explosion in storage under normal atmospheric conditions. Most of the ash from the coking process remains in the coke, but it is still lower than in coal or metallurgical coke, though higher than in other types.

High value outlets for fluid coke, now under study by Standard Oil Development Co. laboratories, include its use as a boiler furnace fuel. It appears to equal or exceed the performance of low-volatile bituminous coal, now low in supply and high in cost.

Metallurgical coke pellets having superior mechanical properties and reduced shatter loss are possible. When suitable means are developed for desulfurizing fluid coke, which tends to concentrate the sulfur from processed crudes, the 70,000,000 ton/yr. blast furnace and foundry coke market will offer an attractive outlet.

Carbon electrodes for the aluminum industry—contingent upon the development of suitable desulfurization and calcining methods for fluid coke—and the manufacture of calcium carbide, phosphorus and carbon disulfide are only a portion of the potential marketable uses for fluid coke.

Fluid coking plants now under way can produce about 200,000 ton/yr. coke with a potential market price of from $5 to as high as $25/ton if present indications are supported by further studies. —R.L.D.

"Fluid Coking and Fluid Coke," by Dr. F. T. Barr and C. E. Jahnig, Standard Oil Development Co., presented at the New York Section meeting, American Institute of Chemical Engineering, Oct. 13, 1954.

NICHOLSON

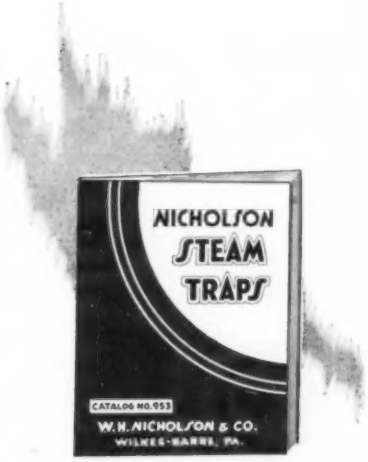
Steam Traps feature

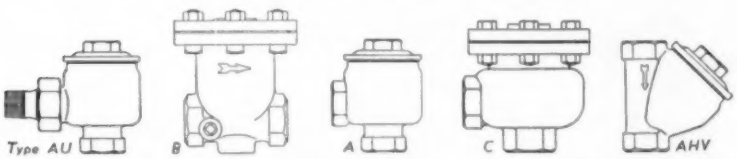
LESS parts

MORE capacity

Note the extreme simplicity of Nicholson industrial steam traps. The heavy-duty bellows integral with valve is the only moving part -- a substantial factor in their low maintenance cost. See also the larger valve orifice. This noteworthy feature results in Nicholson's 2 to 6 times average drainage capacity.

A recent survey showed the features following also to be reasons why plants with standardization-for-economy programs are increasingly adopting Nicholson traps: (1) Operate at lower temperature differential; fast action keeps equipment full of live steam; higher temperatures. (2) No air-binding; eliminate costly fluctuation of operating temperatures. (3) Freeze-proof; freely installed outdoors. (4) No need to change valves for varying operating pressures. (5) Record for low steam waste; as little as 1%.





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Letters

More on Chemofining

To THE EDITORS: . . . We see the hypothetical future situation described in the article ("Chemofining —Petroleum's Future?", July, pp. 1070-4) as a good reflection of many existing enterprises. In some details, of course, the real future situation may differ from the one described. Two examples are the complexity of an operation undertaken by a single company, and the relative importance of fuels and chemicals.

While some petroleum refineries have a far more impressive array of products than is shown in this article, petrochemical plants — of the size shown—for the most part have limited themselves to simpler combinations of operations or at least fewer products.

With an investment of $70,000,000, the "Chemoprep Oil Co." may succeed in "getting the squeal out" of their crude, but may not be able to compete with other less integrated plants. This limitation is implied by the authors.

One way around this difficulty is integration of companies in an area. Such a combination, because of the raw material and sales connections of the participating companies, is more likely to materialize. Several such combinations exist now. . . .

As to the relative unimportance of the "by-product" fuels—this situation does not seem likely to occur. The increasing need for substances such as are listed in the article should go hand in hand with increasing needs for fuels. There may at times be temporary surpluses of fuels (or of chemicals), but they will probably be followed by periods of more extensive conversion to the products demanded. . . .

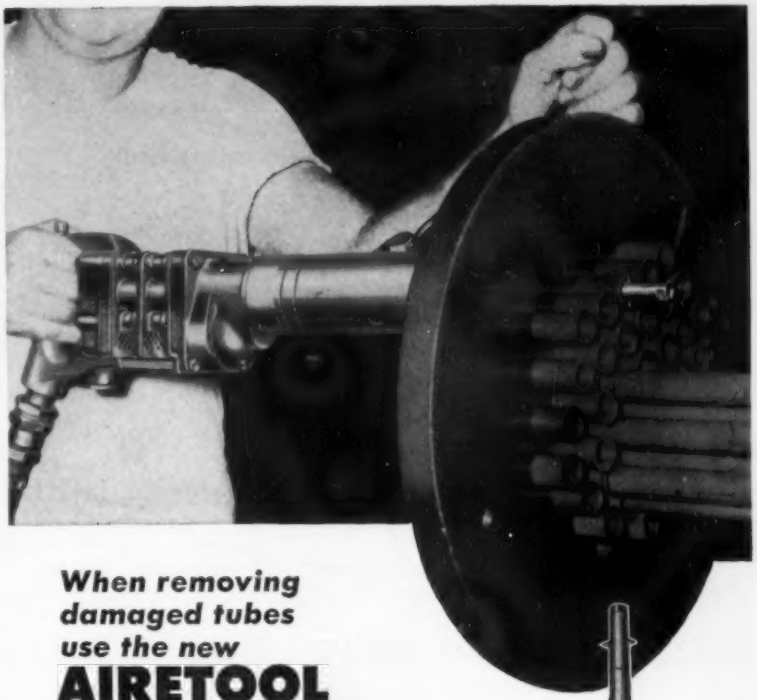
Another feature of future "Chemopet" installations may be their hybrid nature, using both petroleum and coal as raw materials. The shift into coal may be slow for years, but will eventually result in a renaissance of coal. The symptoms of this shift have shown up during the past few years in projects such as the Bureau of Mines' coal hydrogenation project and Carbide & Carbon's coal-from-chemicals work.

. . . We should look back at the development of the petrochemical industry during the past few years. In the light of the past, we should not be surprised at any change or growth we see during the next 10 to 15 years.

D. J. STARK
Plant Manager

National Petro-Chemical Corp.
Tuscola, Ill.

SAVE TIME!



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internal tube cutter

Now . . . a *new,* modern, cost-saving method of removing leaky or damaged tubes from condensers and heat exchangers that enables you to accomplish overhauls in short order and eliminate costly downtime.

The Tube Cutter is a powerful air-driven, fast-cutting lightweight tool that is equally at home in field or plant! Self-centering blades of tough tool steel quickly and easily cut steel or non-ferrous tubes *internally,* through tube sheets up to 4″ thick. A ball-bearing thrust collar prevents friction, and cutting rate is precisely governed by the operator; a lever-controlled positive feed eliminates gouging or burning and insures long life for each of the two cutting bits.

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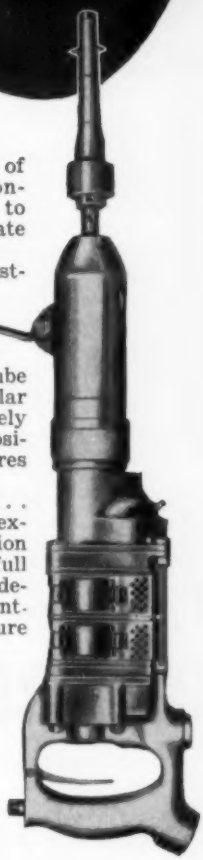

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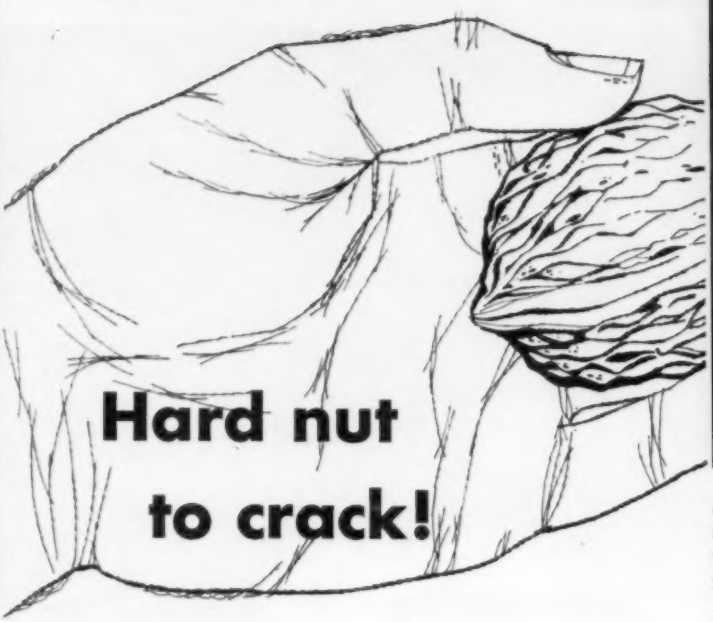
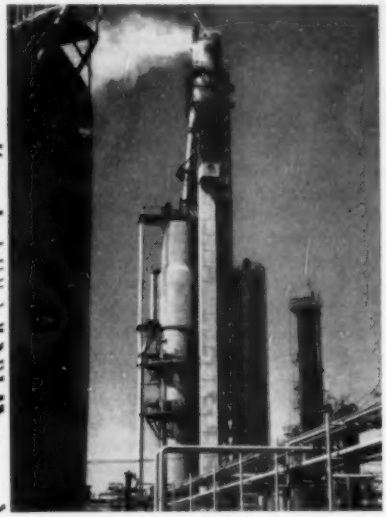
Capsule Case History:



Hard nut to crack!

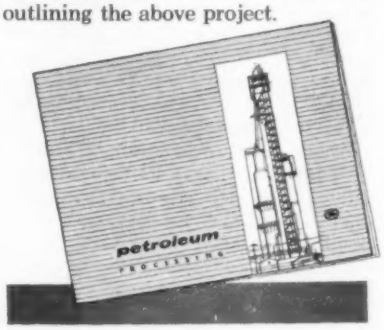
How to expand a plant with a minimum of interference to operations is a problem that calls for an ingenious solution. One example of Kaiser Engineers' planning foresight is its outstanding record of maintaining operating efficiency during the construction period.



A Modern Moving Bed Cat-Cracker was added to a southwest refinery increasing the processing capacity to 19,000 barrels per day. Auxiliary installations included a vis-breaker, vacuum flash tower, syn-crude tower and tar separator.

Downtime to place this unit on stream, was reduced to a minimum even though accelerated scheduling in the fuel oil section was necessary to assist the client in meeting unusual marketing conditions.

Write today for Kaiser Engineers' new petroleum brochure (No. 103) outlining the above project.



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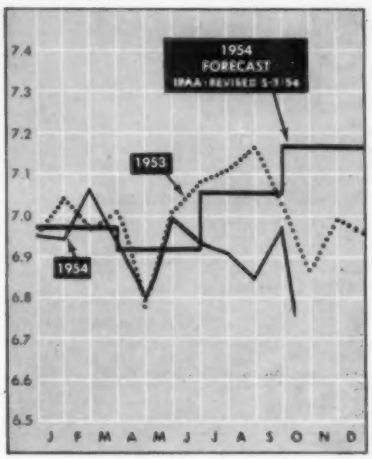
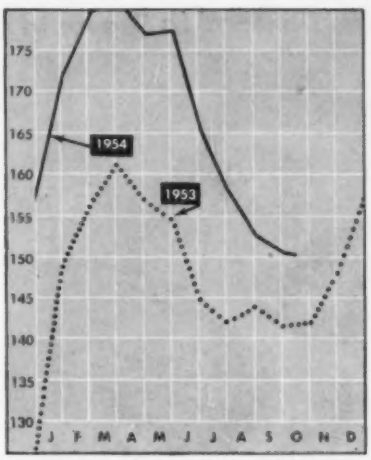
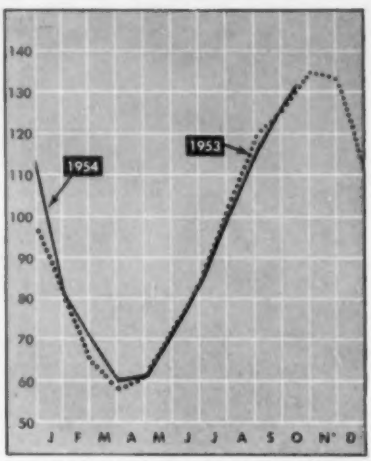


CRUDE RUNS TO STILLS
(Millions of b/d, monthly averages)



PRIMARY GASOLINE STOCKS
(Millions of bbls., end of month)



PRIMARY DISTILLATE STOCKS
(Millions of bbls., end of month)

4th Quarter Demand Off to a Slow Start

OUTLOOK: It will take at least the threat of a cold spell to pull overall product demand much above the low level of the last quarter of 1953.— Even with the brake on crude runs, gasoline inventories Dec. 31 will be well above estimated requirements.

General: The extent to which fuel oil demand is the key factor in refiners' fourth quarter business is again being demonstrated, as it was last year.

Indicated product demand (gasoline, kerosine, distillate and residual fuel) in early October was at a lower rate than even in the same period in 1953, when the mild early winter kept a brake on the wholesale buying of middle distillates. Fourth quarter shipments of the four products last year were 2% less than in the same months in 1952, while demand for all of 1953 was over 3% larger.

This year, however, while heating oil sales lag and exports are lower, other factors should stimulate refiners' fourth quarter business. General business now is on the upgrade, a year ago it was declining. There are around 7% more domestic oil heating plants than a year ago. Even normal seasonal heating oil demand could spark a general improvement in refiners' business.

Crude: Reduced allowables continue to hold U. S. crude production at a low level. Crude runs averaged 6,754,000 b/d avg. for the first half of October, as compared with 6,900,000 b/d avg. for the same weeks last year. Crude runs for the fourth quarter are forecast at 7,200,000 b/d avg.

Inventories: Heating oil stocks (distillates and kerosine) in refiners' tanks Oct. 15 were 171,924,000 bbls., 4,109,000 bbls. larger than on the corresponding date a year ago. In view of the surplus refining capacity in the U. S., which could be called into play later in the winter if required, the present inventories are considered adequate for any early winter needs. Estimated stocks Dec. 31 will be around 135,000,000 bbls., based on normal seasonal requirements. This would be about 5,000,000 bbls. under actual inventories Dec. 31, 1953.

Gasoline inventories at refineries Oct. 15 were 150,928,000 bbls., compared with 140,618,000 bbls. a year ago. The forecast of gasoline stocks Dec. 31, based upon present high yields, is between 158 and 160,000,000 bbls.

KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Oct. 1954*	Sept. 1954	Oct. 1953
CRUDE OIL			
U. S. Production	6.172	6.170	6.262
Imports	.710	.770	.639
U.S. Stocks	271.061	270.794	287.541
Runs to Stills	6.754	6.980	6.872
GASOLINE			
Refinery Output	3.314	3.429	3.359
Refinery Demand	3.474	3.593	3.423
Primary Stocks	150.928	151.979	142.419
HEATING OILS			
Refinery Output	1.799	1.795	1.796
Refinery Demand	1.396	1.309	1.490
Primary Stocks	171.924	165.877	172.945
RESIDUALS			
Refinery Output	1.045	1.097	1.184
Imports	.345	.258	.332
Total Supply	1.390	1.355	1.516
Refinery Demand	1.410	1.341	1.521
Primary Stocks	56.184	56.489	50.820

*Through Oct. 15, except Crude Stocks, which are B. of M. data one day later.

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Oct. 1954*	Sept. 1954	Oct. 1953
Gasoline	11.31	11.46	12.44
Distillates	8.86	8.75	9.05
Kerosine	10.37	10.25	10.38
Residuals	3.97	3.89	3.99
Above 4 Products	8.70	8.72	9.29
Lube Oils	16.25	16.30	18.39
Crude	2.81	2.81	2.83

REFINERY YIELDS

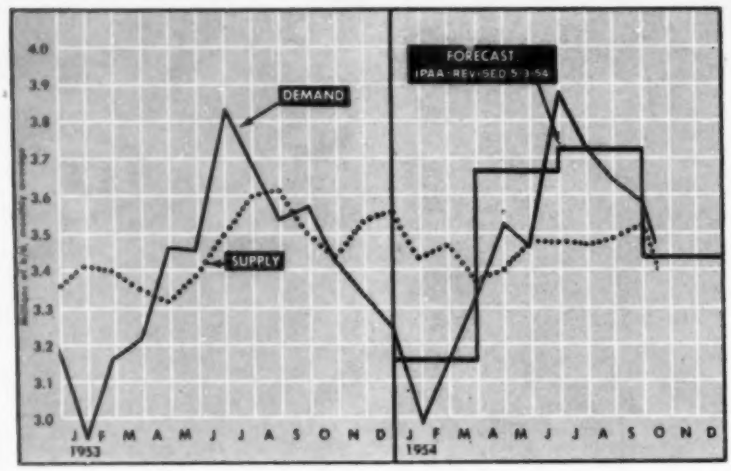
% on Crude Runs to Stills

	Oct. 1954*	Sept. 1954	Oct. 1953
Gasoline	43.8	44.4	43.7
Kerosine	4.5	4.8	4.8
Distillates	22.1	20.7	21.0
Residuals	15.5	15.7	17.1

*Through Oct. 15

SOURCE OF DATA (except prices): Aug., Sept. and Oct., API weekly reports; earlier months, Bureau of Mines

Gasoline Demand in Seasonal Decline

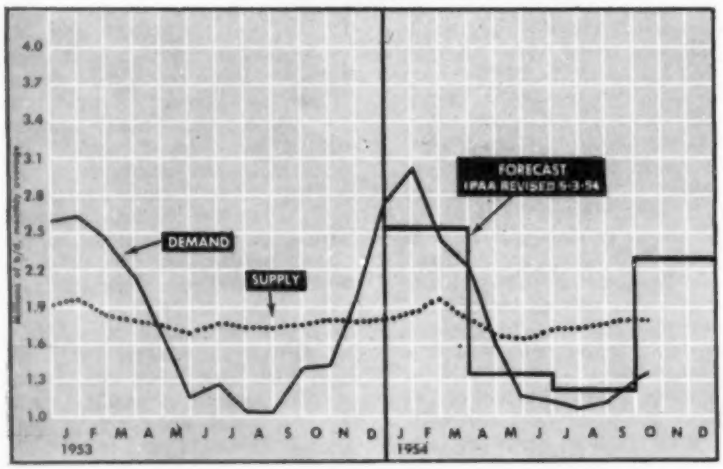


MOTOR FUELS

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Oct. '54*	2.957	.447	3.404
Oct. '53	3.024	.416	3.440
Change	—.067	+.031	—.036
% Change	—2.2	+7.5	—1.0
DEMAND (including Exports) (Millions of b/d)			
Oct. '54*			3.474
Oct. '53			3.423
Change			+.051
% Change			+1.5
TOTAL SUPPLY (Millions of bbls.)			
9 Mos. '54	831.807	113.407	945.214
9 Mos. '53	838.572	105.520	944.092
Change	—6.765	+7.887	+1.122
% Change	—0.8	+7.5	+0.1
TOTAL DEMAND (including Exports) (Millions of bbls.)			
9 Mos. '54			951.527
9 Mos. '53			937.297
Change			+14.230
% Change			+1.5

*Through Oct. 15 only; may not be indicative of the trend for the entire month.

Heating Oil Production Is at 1953 Level

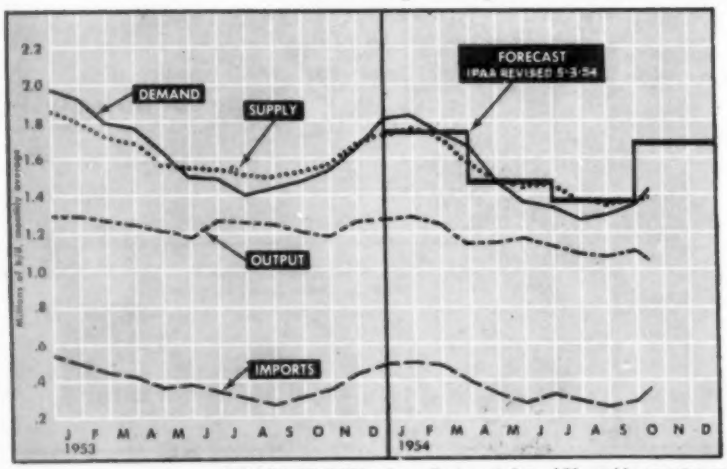


HEATING OILS

	Kerosine	Dist. Fuels	Totals
PRODUCTION (Millions of b/d)			
Oct. '54*	.306	1.493	1.799
Oct. '53	.339	1.457	1.796
Change	—.033	+.036	+.003
% Change	—9.7	+2.5	+0.2
DEMAND (including Exports) (Millions of b/d)			
Oct. '54*	.277	1.119	1.396
Oct. '53	.309	1.181	1.490
Change	—.032	—.062	—.094
% Change	—10.4	—5.2	—6.3
TOTAL PRODUCTION (Millions of bbls.)			
9 Mos. '54	91.327	391.946	483.273
9 Mos. '53	91.446	395.047	486.493
Change	—.119	—3.101	—3.220
% Change	—0.1	—0.8	—0.7
TOTAL DEMAND (including Exports) (Millions of bbls.)			
9 Mos. '54	81.204	379.073	460.277
9 Mos. '53	81.887	372.105	453.992
Change	—.683	+6.968	+6.285
% Change	—0.8	+1.9	+1.4

*Through Oct. 15 only; may not be indicative of the trend for the entire month.

Refinery Output of Residuals Declining



RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Oct. '54*	1.045	.345	1.390
Oct. '53	1.184	.332	1.516
Change	—.139	—.013	—.126
% Change	—11.7	—3.9	—8.3
DEMAND (including Exports) (Millions of b/d)			
Oct. '54*			1.410
Oct. '53			1.521
Change			—.111
% Change			—7.3
TOTAL PRODUCTION (Millions of bbls.)			
9 Mos. '54	314.376	92.604	406.980
9 Mos. '53	337.927	97.832	435.759
Change	—23.551	—5.228	—28.779
% Change	—7.0	—5.3	—6.6
TOTAL DEMAND (including Exports) (Millions of bbls.)			
9 Mos. '54			403.597
9 Mos. '53			438.319
Change			—34.722
% Change			—7.9

*Through Oct. 15 only; may not be indicative of the trend for the entire month.

SOURCE OF DATA: Aug., Sept. and Oct., API weekly reports; earlier months, Bureau of Mines

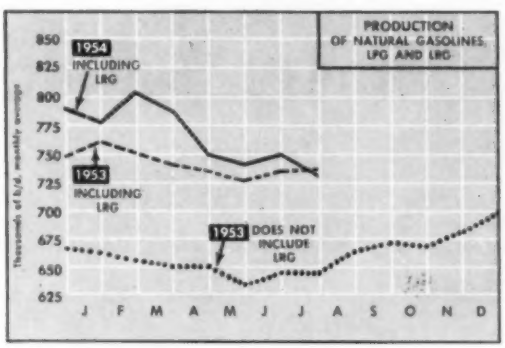
RUNS TO STILLS and DISTRIBUTION OF PRIMARY STOCKS BY U.S. REFINERY DISTRICTS

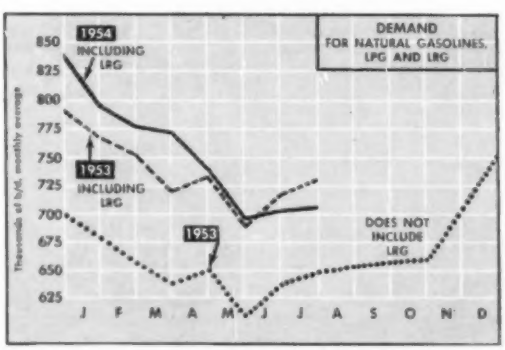
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change	RESIDUAL STOCKS (Millions of bbls., on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change
East Coast	1.014	1.037	— .023	— 2.2	34.639	33.296	+ 1.343	+ 4.0	10.630	13.312	—2.682	—20.1
Gulf Coast	2.244	2.132	+ .112	+ 5.3	29.374	26.871	+ 2.503	+ 9.3	7.446	8.707	—1.261	—14.5
Total Coastal	3.258	3.169	+ .089	+ 2.8	64.013	60.167	+ 3.846	+ 6.4	18.076	22.019	—3.943	—17.9
Appalachian	.171	.178	— .007	— 4.0	6.627	5.727	+ .900	+15.7	.831	.880	— .049	— 5.6
Ind.-Ill.-Ky.	1.184	1.281	— .097	— 7.6	33.081	26.861	+ 6.220	+23.1	4.402	4.806	— .404	— 8.4
Okla.-Kans.-Mo.	.596	.607	— .011	— 1.8	13.480	14.436	— .956	— 6.6	1.298	1.237	+ .061	+ 4.9
Other Inland	.545	.601	— .056	— 9.3	15.487	13.643	+ 1.844	+13.5	2.222	2.594	— .372	—14.3
Total Inland	2.496	2.667	— .171	— 6.4	68.675	60.667	+ 8.008	+13.2	8.753	9.517	— .764	— 8.0
Total East of Calif.	5.754	5.836	— .082	— 1.4	132.688	120.834	+11.854	+ 9.8	26.829	31.536	—4.707	—14.9
California	1.011	1.030	— .019	— 1.8	18.240	19.784	— 1.544	— 7.8	29.355	21.567	+7.788	+36.1
Total U.S.	6.765	6.866	— .101	— 1.5	150.928	140.618	+10.310	+ 7.3	56.184	53.103	+3.081	+ 5.8

District	DISTILLATE STOCKS (Millions of bbls., on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change	KEROSINE STOCKS (Millions of bbls., on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change	TOTAL HEATING OIL STOCKS (Millions of bbls., on date shown) Oct. 15 1954	Oct. 16 1953	Change	% Change
East Coast	49.268	47.913	+1.355	+ 2.8	15.399	15.027	+ .372	+ 2.5	64.667	62.940	+1.727	+ 2.7
Gulf Coast	21.416	23.779	—2.363	— 9.9	7.800	6.996	+ .804	+11.5	29.216	30.775	—1.559	— 5.1
Total Coastal	70.684	71.692	—1.008	— 1.4	23.199	22.023	+1.176	+ 5.3	93.883	93.715	+ .168	+ 0.2
Appalachian	3.545	2.264	+1.281	+56.6	1.231	1.241	— .010	— 0.8	4.776	3.505	+1.271	+36.3
Ind.-Ill.-Ky.	25.786	23.808	+1.978	+ 8.3	9.989	9.442	+ .547	+ 5.8	35.775	33.250	+2.525	+ 7.6
Okla.-Kans.-Mo.	13.186	12.623	+ .563	+ 4.5	2.451	2.478	— .027	— 1.1	15.637	15.101	+ .536	+ 3.5
Other Inland	6.462	5.913	+ .549	+ 9.3	1.557	1.628	— .071	— 4.4	8.019	7.541	+ .478	+ 6.3
Total Inland	48.979	44.608	+4.371	+ 9.8	15.228	14.789	+ .439	+ 3.0	64.207	59.397	+4.810	+ 8.1
Total East of Calif.	119.663	116.300	+3.363	+ 2.9	38.427	36.812	+1.615	+ 4.4	158.090	153.112	+4.978	+ 3.3
California	13.465	14.351	— .886	— 6.2	.369	.352	+ .017	+ 4.8	13.834	14.703	— .869	— 5.9
Total U.S.	133.128	130.651	+2.477	+ 1.9	38.796	37.164	+1.632	+ 4.4	171.924	167.815	+4.109	+ 2.4

Natural Gas and Refinery Gas Liquids





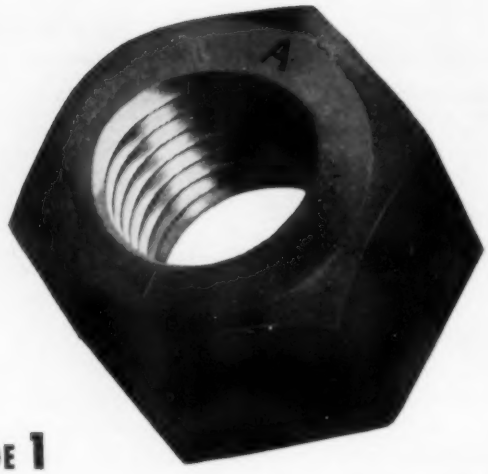
SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	July 1954	June 1954	July 1953
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	286	299	292
Natural Gasoline and Isopentane	273	274	266
Condensate	24	27	23
Finished Gasoline, Naphtha and Others	59	59	67
Total Natural Gasoline and Cycling Plant Production	642	659	648
Liquefied Refinery Gases	92	94	89
Total Marketable Gas Liquids	734	753	737
Lease Condensate	100	99	86
Total Natural Gas Liquids	834	852	823
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	362	354	363
Natural Gasoline, Isopentane and Other	344	349	370
Total Current Demand	706	703	732

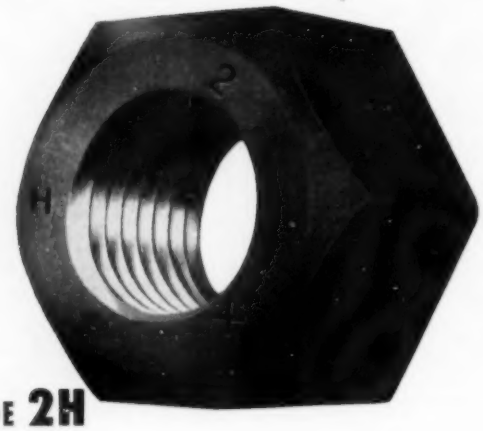
CUMULATIVE PRODUCTION (1000 bbls.)	July 1954	July 1953
LPG and LRG	87,958	80,854
Natural Gasoline, Isopentane and Other	74,171	73,851
Total Marketable Gas Liquids	162,129	154,705
CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	83,311	80,854
Natural Gasoline, Isopentane and Other	73,754	73,851
Total Cumulative Demand	157,065	154,705

STOCKS (1000 bbls., end of Month)	July 1954	June 1954	July 1953
LPG and LRG	9,123	8,616	4,266
Natural Gasoline, Isopentane and Other	5,306	4,958	4,755
Total Stocks	14,429	13,574	9,021



GRADE 1

GRADE 2



GRADE 2H

GRADE 4

4 Grades of Nuts for Refinery Bolting

You wouldn't think of using any ordinary type of nut for high-temperature, high-pressure bolting. Instead, you'd select a nut that you knew you could count on for good service. But which grade of nut? Which is best for a given application?

To enable you to choose the right nut every time, Bethlehem produces four different grades of hexagonal nuts, each of them meeting the requirements of ASTM Spec. A-194. They are tapped to Class 2 fit, and are available in sizes from ⅜ in. to 2 in. Grades 1, 2 and 2H are carried in stock.

If you have any question about the choice of a Bethlehem nut, or the carbon or alloy stud with which it is used, please call the nearest Bethlehem sales office.

GRADE 1. A low-carbon-steel nut for non-critical applications. Also suitable for service at moderately elevated temperatures. Carbon 0.15 min, Phosphorous 0.05 max, Sulphur 0.05 max. Brinell 120 min.

GRADE 2. A medium-carbon-steel nut, for use at moderate temperatures and pressures. Carbon 0.40 min, Phosphorous 0.05 max, Sulphur 0.05 max. Brinell hardness 160 min.

GRADE 2H. Quenched and tempered. Ideal for long service at high temperatures and pressures. Carbon 0.40 min, Phosphorous 0.05 max, Sulphur 0.05 max. Brinell hardness 248 to 352.

GRADE 4. A molybdenum-steel nut, heat-treated. Is ideal for severe temperature and pressure conditions. Also suitable for sub-zero temperatures, as it has minimum Charpy impact value of 15 ft-lb down to -150 F. Carbon 0.40 to 0.50, Manganese 0.50 to 0.95, Phosphorous 0.04 max, Sulphur 0.05 max, Silicon 0.15 min, Molybdenum 0.20 min. Brinell hardness 248 to 352.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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BETHLEHEM High-Temperature FASTENERS

BETHLEHEM STEEL

PETROLEUM CHEMICALS DIVISION
NEWS

November ★ One of a Series of Interest to the Petroleum Industry ★ 1954

Du Pont announces

NEW TYPE LUBE OIL ADDITIVES to solve low-duty sludge problems

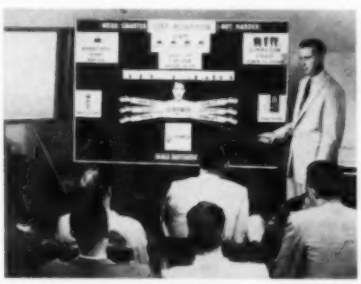
New Du Pont Lube Oil Additive 564 and Lube Oil Additive 565 are both polymeric additives. Both are outstanding detergents and viscosity index improvers. They are exceptionally effective in retarding sludge formation under stop-and-go driving conditions.

Different molecular weights distinguish the two additives. Now available in commercial quantities, they can be used in extremely low concentrations with substantial dollar savings over the use of conventional additives.

NEW "SHOW" HAS MILLION-DOLLAR PLOT

Here's a "show" that will never hit Broadway . . . but you won't want to miss it.

It's the Du Pont Cost Reduction Show. It's based on a systematized method of reducing costs which our company has developed over many years of manufacturing experience. Since it has proved so effective in our own plants—resulting in savings running into millions of dollars—we thought some of our friends in the oil industry would like to have us review it for them.



THIS FLANNELBOARD DISPLAY is part of the 40-minute Du Pont Cost Reduction Show.

Dramatic presentation

To get over the key points quickly and dramatically, we have organized the story into a three-part presentation . . . including a flannelboard talk, a motion picture, and a slide presentation.

Du Pont's program is certainly no magic formula that works miracles. It is, however, unique with respect to its formalized organization, and the high degree of employee participation it has accomplished. The key to its success is the development of a cost-conscious attitude in the minds of *all* employees.

Work smarter . . . not harder

The Cost Reduction Show describes how work simplification training and a suggestion plan are integrated into the program. The functions and value of a full-time co-ordinator, and his role as an aid to line organization are discussed in detail. Emphasis is placed on promotion of the program to a point where cost reduction becomes a *work habit* . . . and helps to improve human relations as well as efficiency.

A number of Du Pont men in various parts of the country are now being trained to put on the show for the oil industry. Showings are limited to oil company offices and refineries. For more details about the Cost Reduction Show, we suggest you get in touch with one of the Du Pont Petroleum Chemicals Division regional offices.

"Looking through the windshield"

Looking at each other through the windshield is where dealers and motorists first meet. Du Pont can help your dealers get better acquainted with customers through a series of clever little folders called "Looking through the windshield."

What the motorist sees through his windshield when he stops for gasoline spells the difference between a successful service station . . . and a business that is just getting by. This fact is mighty important to every one of your dealers. But how many of them use it to their own advantage?

THIS CUSTOMER'S EYE-VIEW can spell the difference between success or failure for a service station business. A new series of Du Pont folders can help your dealers give their customers a "better" view.

The chances are that if your dealers could get a better understanding of their customers, they would, in turn, be better prepared to give these customers a favorable impression of the service station. Here's how the Du Pont Petroleum Chemicals Division can help you with

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *"The Windshield"*

this important project.

"Looking through the windshield" is the theme of a new series of folders for your dealers. Each of the folders in the series discusses a specific phase of service station business . . . (1) the customer himself, (2) "regular" and "premium" purchases, (3) use of credit cards, (4-5) oil and TBA buying habits, and (6) free dealer services.

Each is a 4-page folder with an intriguing *cutout* "windshield" looking through the front cover into the inside of the folder at the dealer. The folders achieve an interesting three-dimensional effect as a result of this unusual art treatment.

They are based on information uncovered by Du Pont's recent extensive survey of consumer gasoline buying habits. But they explain each point in simple, straightforward language that can be readily understood and easily remembered by any dealer or service station attendant.

"A close look at the man behind the wheel" is the title of the first in the series. What your dealers know about this "man behind the wheel"—can have an important bearing on sales and profits . . . for both you and your dealers.

The average motorist, for example, is loyal to one station—and buys at least 75% of his gasoline there. The folder points out, therefore, that the more a

THE "WINDSHIELD" THEME is effectively dramatized in each folder by a die-cut through the cover page—which shows the dealer looking out from an inside page.

dealer can do to increase customer *loyalty*, the better his business will be. But *how* can he do this? . . .

If the customer is under 35, the chances are that *friendship* is the basic ingredient in his loyalty. Motorists over 35, on the other hand, tend to base their loyalty more on the kind of *service* they receive.

Although subtle, these are important points for every dealer to know and understand. And this new folder helps him to understand them in terms of his own cash register.

Quantities of "A close look at the man behind the wheel," the first in this series are now available for distribution to your dealers. Any Du Pont Petroleum Chemicals Division representative or regional office will be glad to give you sample copies . . . and cost information for ordering them in large quantities.

"MAGIC BARREL" ON EUROPEAN TOUR

On October 4, two representatives of the Petroleum Chemicals Division, R. Carter W. Jones and Roberts W. Brokaw, took off for Europe—each with a "Magic Barrel."

They are taking part in a 6-week European tour sponsored by the National Sales Executives, Inc. Its aim is to acquaint European businessmen with American methods of selling. The "Magic Barrel" was picked to be included in the tour as an example of a unique and interesting method of selling an industry to the general public.

When the tour is concluded in Paris on November 13, the "Magic Barrel" will have been seen by audiences in 27 major cities of 20 European countries.

In addition to the Du Pont men, the Sales Executives group includes representatives from 10 other American companies.

New Phase of Antiknock Research Discussed in Paper

Engines are now being operated on hydrogen and carbon monoxide at the Du Pont Petroleum Laboratory. The operation is part of the Laboratory's extensive antiknock research program.

This work was recently discussed in a paper presented at the west coast meeting of the Society of Automotive Engineers by Dr. B. M. Sturgis, who co-ordinated the project at the Petroleum Laboratory.

The paper, one of the most comprehensive on knock and antiknock action to be presented since the end of World War II, brings out several significant findings. For example, the Du Pont experiments helped to determine what similarities exist between hydrogen combustion and hydrocarbon combustion. And experiments with carbon monoxide showed that water vapor, which could not be eliminated from the fuel-air mixture, entered into the combustion process to produce knock.

This lends further support to the theory that knock reaction may be related to the presence of simple hydrogen and oxygen containing radicals . . . and that tetraethyl lead inhibits knock by suppressing the action of these radicals.

A copy of the paper can be easily obtained from any of the Petroleum Chemicals Division regional offices listed below.

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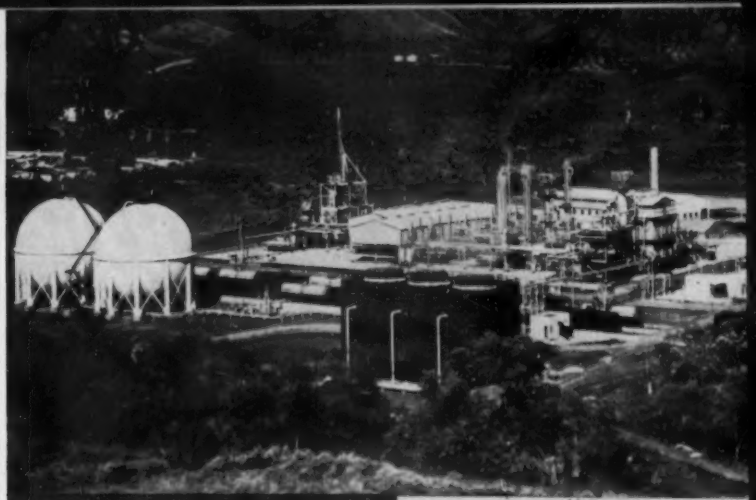
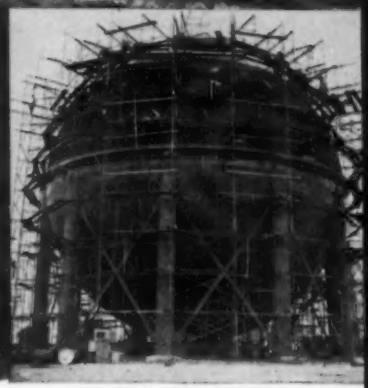




At left workman applies lightweight FOAMGLAS easily and quickly. At lower right is shown the sphere during installation of FOAMGLAS. Above is Shell's Ventura plant. The two spheres are insulated with FOAMGLAS.

FOAMGLAS stay-dry insulation helps SHELL keep ammonia a constant 39°

Temporary storage of 3 million gallons of anhydrous ammonia in three huge refrigerated spheres is strictly routine now at Shell Chemical Corporation's new plants at Ventura and Kerman, California, thanks to the use of FOAMGLAS to insulate the million gallon spheres.

Two years ago Shell Chemical invested $10,000,000 in this new plant. Its product is pure ammonia which is handled as a liquid and kept in that state by storing it at a pressure of 50 psi and by refrigerating it to 39° F. For this purpose Shell erected two 65 ft. diameter spheres at Ventura and one at nearby Kerman.

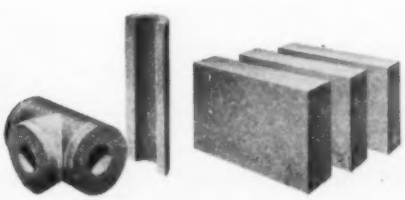
Keeping ammonia constantly at 39° F. calls for good insulation of the spheres. One of the reasons FOAMGLAS was selected for the job is that it stays dry. No other insulation has waterproof, sealed glass cells to provide constant insulating efficiency and protection of the spheres from corrosion.

FOAMGLAS has other unique properties too. It's fireproof, acid-proof and unaffected by contact with ammonia . . . further reasons why cellular glass was chosen to insulate all of the other refrigerated equipment and piping throughout these plants.

You will really profit when you insulate with FOAMGLAS. For the full story, send today for a sample and our booklet describing the use of FOAMGLAS to insulate piping, tanks and other equipment.

PITTSBURGH CORNING CORPORATION
Dept. PP-114 • One Gateway Center • Pittsburgh 22, Pa.

FOAMGLAS®
the cellular, stay-dry insulation



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Pittsburgh Corning also makes PC Glass Blocks

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Please send me brochure on the Gilbarco Electronic Tank Gauge.

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NOW YOU CAN MAINTAIN 100% GREATER ACCURACY

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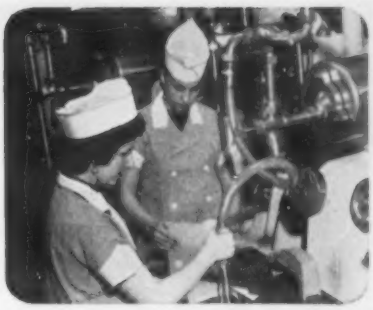
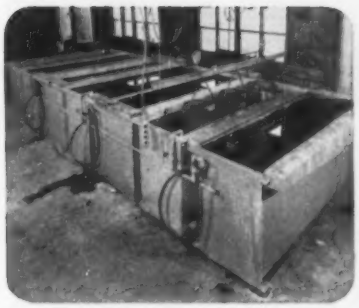
Here are five ways to use versatile-flexible

TYGON PLASTICS



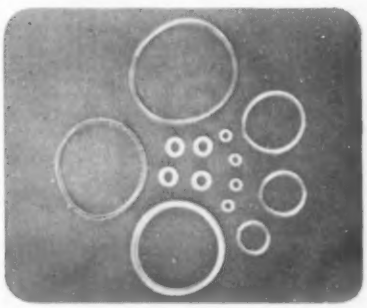
AS TUBING OR HOSE to pipe taste-sensitive liquid foods or corrosive chemicals. Tygon Tubing is glass-clear, flexible as a piece of string, resistant to acids and alkalies, non-toxic, sterilizable, and is made in bores from 1/16″ to 2″.

AS A PAINT to protect plant and equipment from attack by corrosive fumes and gases. Applied by brush or spray, Tygon air dries quickly to form a tough impermeable plastic skin that shrugs off acids, alkalies, oils, water and alcohols.



AS A HEAVY-DUTY LINING to protect the interior of pickling, plating, chemical processing and storage tanks from destruction by corrosive solutions. Easier to install than rubber linings, Tygon can be applied to tanks of any size or shape.

AS A CORROSION-RESISTANT GASKETING. Tygon shows no chemical deterioration with age. Gaskets remain flexible and tight, unaffected by weather or exposure to chemicals. Tygon gaskets are available in an almost unlimited size range.



AS MOLDED ITEMS. Tygon's toughness, durability and flexibility, coupled with staunch chemical resistance, offer pronounced performance characteristics for grommets, washers and molded mechanical goods items in virtually any shape.

Tygon is but one of a number of specialized materials manufactured and fabricated by The United States Stoneware Company or its affiliated divisions. Other products include: chemical ceramics, in stoneware or porcelain; sintered metallic oxides; natural, neoprene, silicone or other synthetic rubbers; acid brick and cements; adhesives and organic bonding agents, and specialized processing equipment.

WRITE TODAY for the TYGON PORTFOLIO. *Pertinent data and technical characteristics of the various Tygon compounds to enable you to determine just how you can use Tygon most advantageously. Free, on request. Address Dept. PP-1154*

U. S. STONEWARE

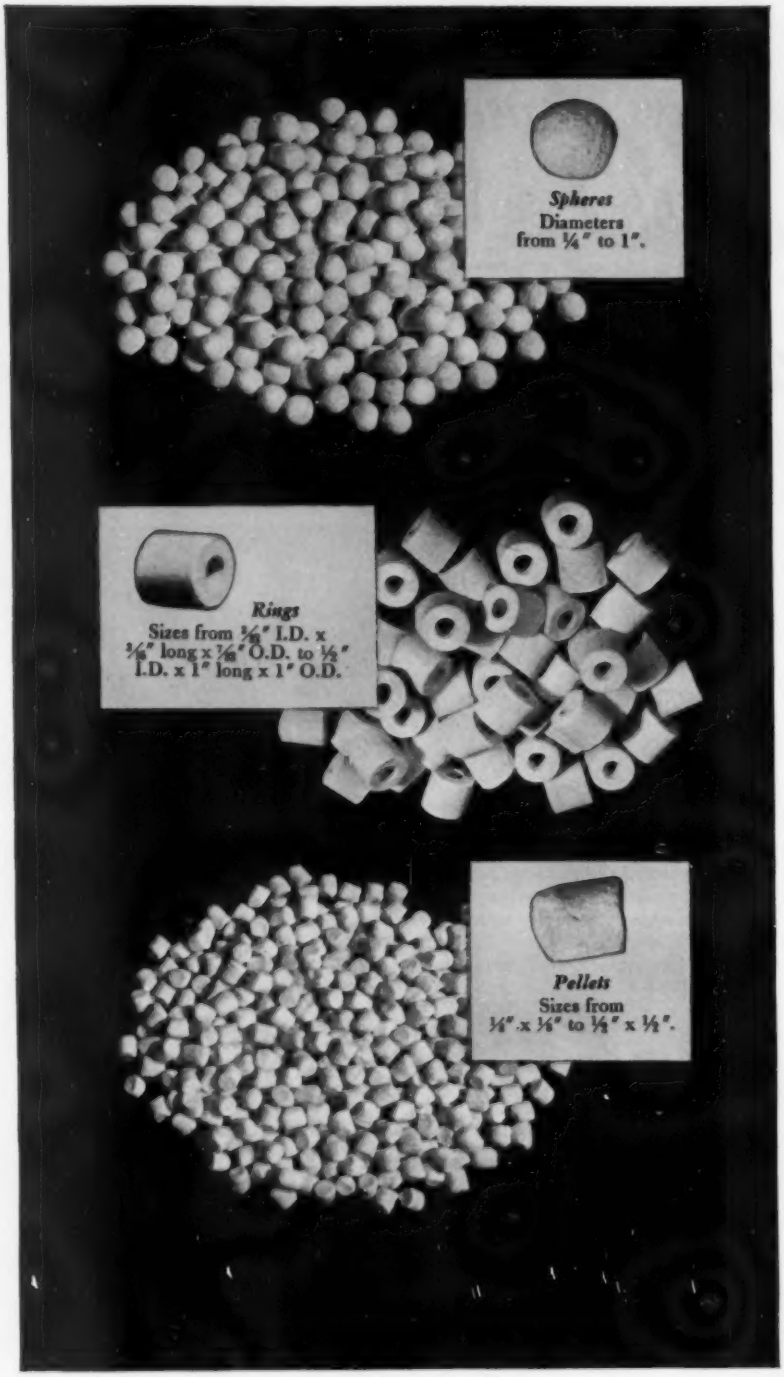
PLASTICS and SYNTHETICS DIVISION

Akron 9, Ohio

New York **Chicago** **Houston**

497-0

(To obtain more data on advertised products see page 1784)

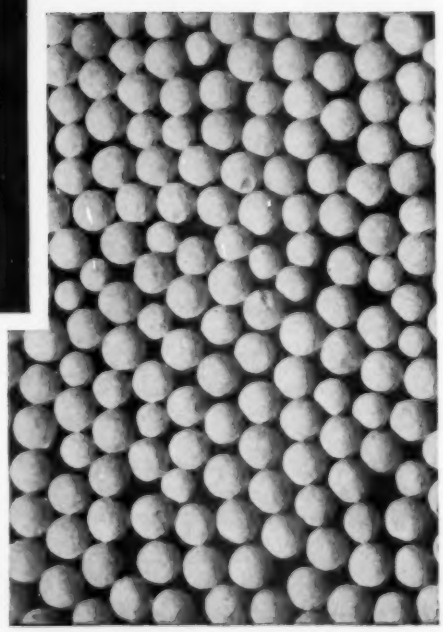


Rx for

Norton catalyst carriers — spheres, pellets and rings — are commercially available in ALUNDUM*, (fused alpha alumina) mixtures. Experimental quantities are available in MAGNORITE*, FUSED STABILIZED ZIRCONIA, CRYSTOLON* and MULLITE.

Norton spherical carriers provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres have porosity ranging from 40% to 44% with a network of open pores on the outside surface only. These are suitable for applications where the carrier is coated with a catalyst. High porosity spheres have porosity ranging from 45% to 49%, with a network of open pores on the outside surface as well as throughout the entire sphere. These are suitable for applications where the carrier is impregnated with a catalyst.

Norton ALUNDUM carriers are proving highly successful in reaction such as those involved in the manufacture of phthalic anhydride, maleic anhydride and oxidation of ethylene. Containing 77% to 89% alumina, they are outstanding for chemical stability and resistance to abrasion and erosion. Write for Bulletin #7, containing additional data on ALUNDUM catalyst carriers.



Norton heat exchange pebbles are made of ALUNDUM. Because of their high alumina content (over 95%) they are ideally suited for pebble type heaters, where they are important as the heat-transfer medium, whether oxidizing or reducing conditions are encountered.

Their ability to withstand abrasion, impact and repeated heating and cooling makes them ideal for heat exchange beds of either the static or moving type. Their high refractoriness prevents softening or incipient fusion at any point in the upper bed. This keeps them from "bridging" together and causing stoppages in a moving bed. ALUNDUM heat exchange pebbles are available in ¼, 5/16, ⅜ and ½" diameters.

(To obtain more data on advertised products see page 1784)

higher production... better processing...lower costs

Norton refractories are engineered for top performance — and prescribed for many chemical applications

For your refractory uses, Norton refractory products are *engineered and prescribed* to give you the best possible Rx — the most effective combination of physical characteristics plus thermal, chemical and electrical properties.

The Rx's you need to improve and economize your processing are ready for you in this complete, top-quality line. For details, including expert technical aid, call in your Norton Refractories Engineer. Meanwhile, write for the fact-filled bulletins, mentioned in this advertisement, that cover your particular requirements for dependable, money-saving refractories. NORTON COMPANY, 270 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

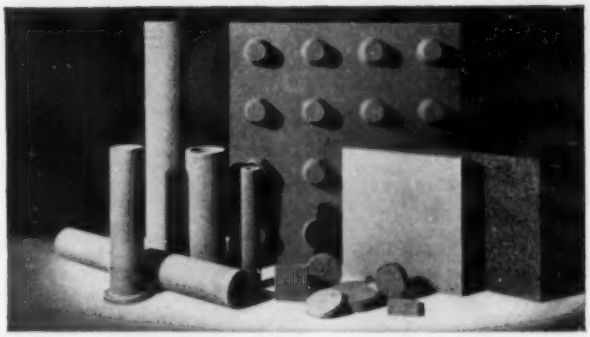
NORTON

REFRACTORIES

Engineered... Rx... Prescribed

Making better products... to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



Norton porous mediums come in plates, tubes, discs and diaphragms, engineered to fit your filtering, diffusing or aerating requirements. All have uniform porosity, in the size and open-pore ratio you need. Made of ALUNDUM material that is chemically stable and strong. Thus, their resistance both to acid and alkaline conditions gives them extra long life. Norton seamless porous tubes have the advantage, unusual in tubes, of uniform porosity over their entire area — permitting constant air or liquid pressure and enabling uniform backwashing to do more thorough cleaning.

Typical applications are filtering water or solvents; cutting oils, wine and other liquids; reclaiming cleaning fluids; handling industrial oil wastes. Bulletin No. 140 tells you more about Norton ALUNDUM porous mediums.

Norton electric furnace shapes and laboratory ware

Norton electric furnace refractories — cores, tubes and muffles — are made of ALUNDUM or CRYSTOLON materials. ALUNDUM shapes, composed of 99% pure fused alumina, are characterized by great stability, chemical inertness, excellent thermal conductivity and good electrical insulation qualities. CRYSTOLON shapes, for use under more limited conditions, combine high thermal conductivity with resistance to heat shock. Bulletin No. 458 tells how to construct electrical furnaces for the laboratory.

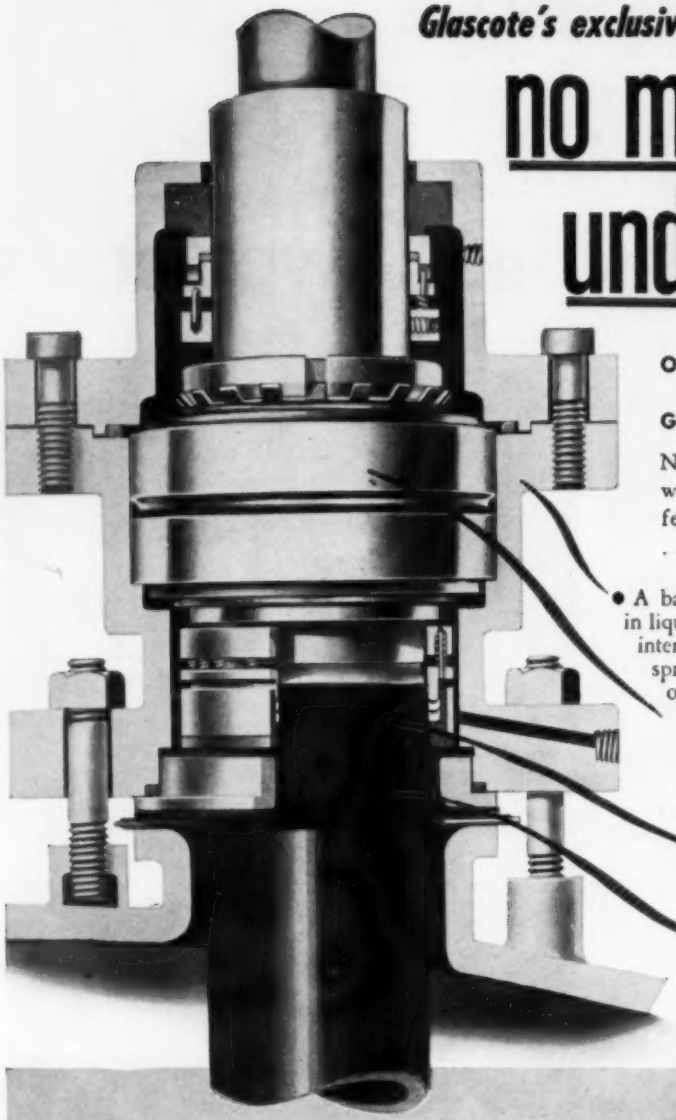
Norton ALUNDUM laboratory ware, available at your laboratory supply house, offers many properties important to development, experimental or analytical work. It is chemically stable, stands temperatures up to 1900°C and is easy to clean. For filtering, it comes in four degrees of permeability. Bulletin No. 793 gives you the whole story.

Norton refractory shapes for reaction furnaces come in bricks, plates, tubes and blocks, made of ALUNDUM, CRYSTOLON, MAGNORITE and FUSED STABILIZED ZIRCONIA refractory materials. The development of FUSED STABILIZED ZIRCONIA is a typical example of how Norton aids you in utilizing higher temperatures for greater efficiency and output. Norton was the first to bring this valuable material out of the experimental stage into commercial production. Now it is used in many processes.

No other refractory is so chemically stable at such high temperatures under both oxidizing and reducing conditions. In gas synthetic processes, furnaces lined with it have withstood temperatures approaching 4700°F for long periods. Its low thermal conductivity (6.2 BTU in dense shapes at 2000°F) and its high electrical conductivity at high heat are other important properties, all of which are described in Bulletin No. 1409.

Glascote's exclusive rotary mechanical seal means

no more leakage under pressure



OPERATING GLASS-LINED VESSELS UNDER TOXIC OR EXPLOSIVE CONDITIONS? GLASCOTE'S POSITIVE SEALING IS THE ANSWER!

No other seal is so effective on glass-lined vessels with top-entering glass-coated agitators. Exclusive features promote successful use of higher pressures . . . prevent contamination of vessel contents.

- A balanced pressure system. Pressure in liquid-tight housing is kept higher than internal vessel pressure through use of coil springs and pressure-circulation of oil or other cooling lubricant.
- Timken bearing assures constant alignment of sealing surfaces . . . prevents agitator wobble. Sealing materials are a carbon gland insert and seal-rings of insoluble Teflon.
- Blue color shows how glass lining extends up into the unit . . . past tight-sealing carbon insert. No contaminating material can enter the vessel.
- Ground glass portion of agitator shaft promotes snug fit.

Glascote
now serves you
as a subsidiary of
A.O.Smith

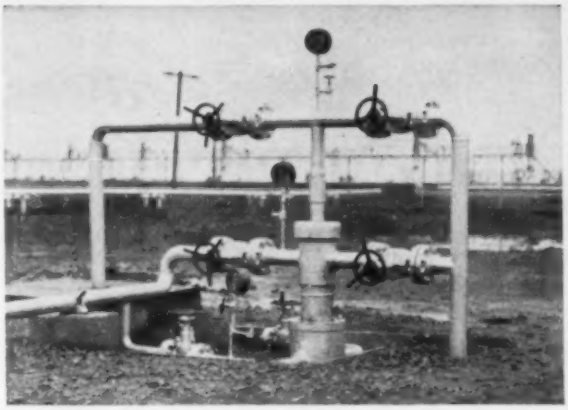
IT was a significant merger indeed when Glascote joined A. O. Smith—world's largest manufacturer of glass-lined steel products. Now A. O. Smith's facility and research in ceramics and metallurgy broaden the working range of Glascote's own technicians.

Processors can count on a continuous flow of exclusive developments like the one featured above. They will continue to enjoy the superior corrosion-resistance and advanced design of Glascote reactors, receivers, condensers, evaporators, storage tanks and transport tanks.

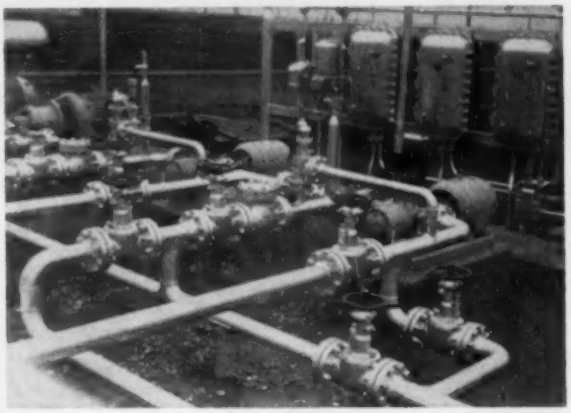
You will find Glascote products in use at duPont, Carbide & Carbon, Naugatuck, Dow and other companies. How about your plant?

Glascote
PRODUCTS, INC.
CLEVELAND 17, OHIO
A Subsidiary of A. O. Smith Corporation
Sales offices or agents in Principal Cities
Export Sales: A. O. Smith Corp., International Division, Milwaukee 1, Wis.

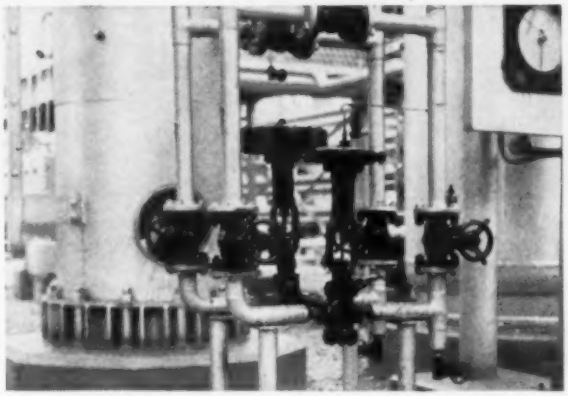
look where ORBIT VALVES are serving



Surface installations over propane underground storage well in Kansas.



Suction and discharge propane and water lines at underground storage project in Kansas.



Blending tanks. Blending 18 lb. gasoline up to 38 lbs. vapor pressure.

Manifold dome — propane surface storage.

here's how ORBIT VALVES can help reduce your operating costs

Orbit Forged Steel LP-Gas Valves are *vapor tight* because:

- The body and bonnet are made of drop forged steel which greatly increases the density of the metal.
- The bonnet is welded to the body. This eliminates leaks that sometimes occur in bolted bonnet type valves.
- The stem packing chamber is equipped with adjustable plastic packing that can be added to if necessary while the valve is in service and under pressure.
- A positive seat shut-off through Orbit's principle of friction free seating.

ORBIT VALVES®

There is Only One ORBIT VALVE

ORBIT VALVE COMPANY

P. O. BOX 699 TULSA, OKLAHOMA

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407 Velasco
(Serving the Gulf Coast)

CASPER, WYOMING
247 West First Street
(Serving the Rocky Mountain States and Canada)

ODESSA, TEXAS
402 West County Road
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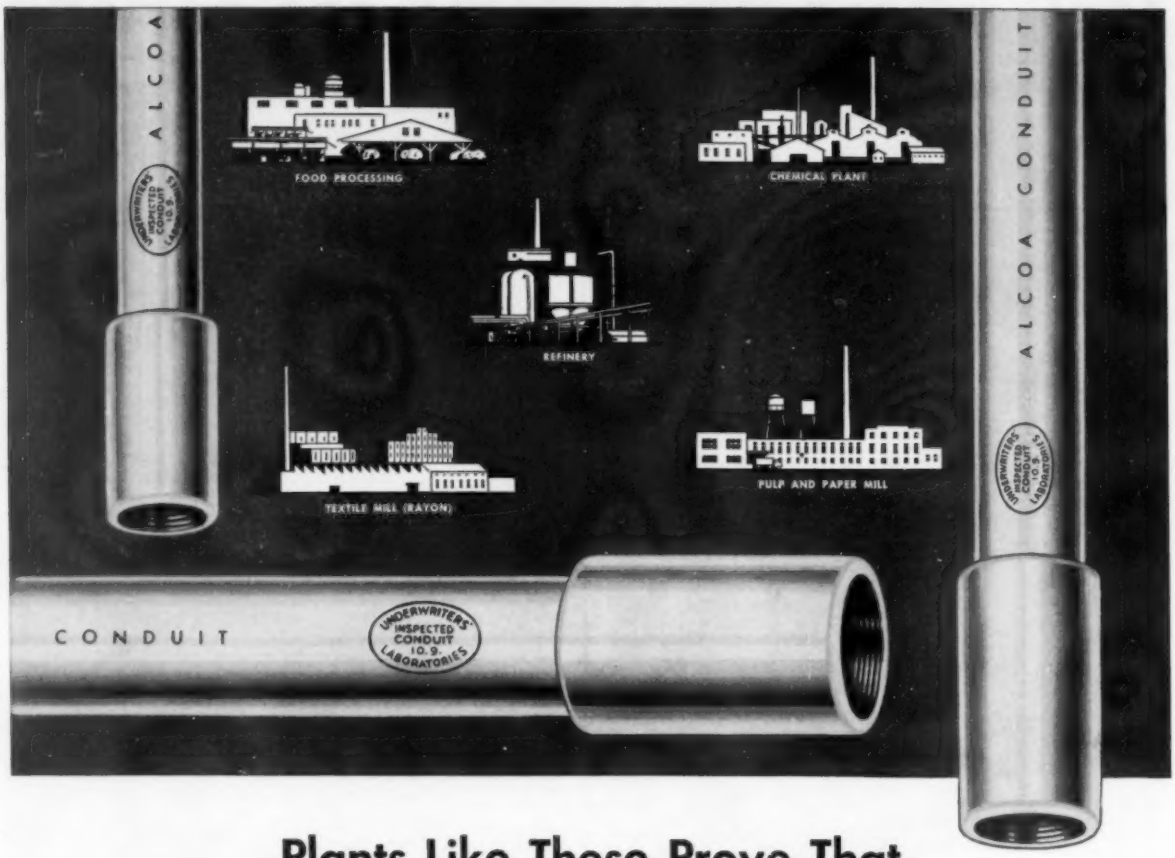


Plants Like These Prove That ALCOA® ALUMINUM RIGID CONDUIT Is the Lowest Cost Corrosion-Resistant Conduit

Alcoa Aluminum Rigid Conduit, especially resistant to industrial atmospheres that often attack other metals, costs less than any other corrosion-resistant conduit. The excellent performance of aluminum conduit in corrosive conditions means lower maintenance costs and less frequent replacement.

In addition, Alcoa Aluminum Rigid Conduit is nonmagnetic, lowers voltage drop, eliminates overcrowding of terminal enclosures and simplifies the installation of electrical equipment having widely spaced terminals.

Alcoa Aluminum Rigid Conduit reduces handling, fabricating and installation costs. It is only about one-third the weight of the same size in steel. A 10′ length of the 4″ size weighs only 33 pounds and can easily be handled by one man.

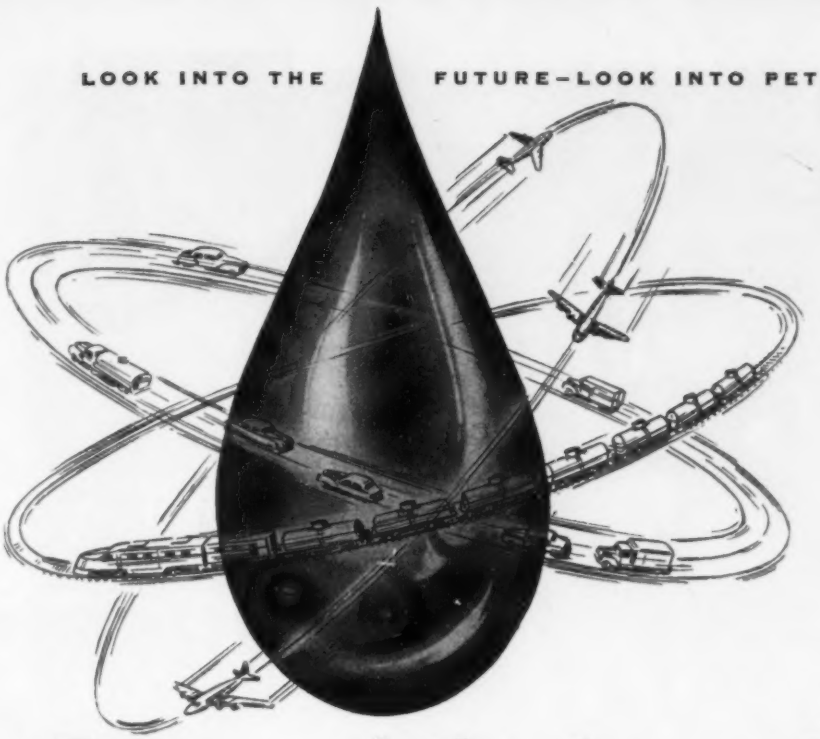
Alcoa Aluminum Rigid Conduit is readily available. Approved by Underwriters' Laboratories, Inc., each piece bears their label. Call your local Alcoa sales office, listed under "Aluminum" in your classified directory. ALUMINUM COMPANY OF AMERICA, 2093-L Alcoa Building, Pittsburgh 19, Pa.

For complete information write for Alcoa's new booklet, *Alcoa Aluminum Electrical Rigid Conduit.*

ALCOA ALUMINUM

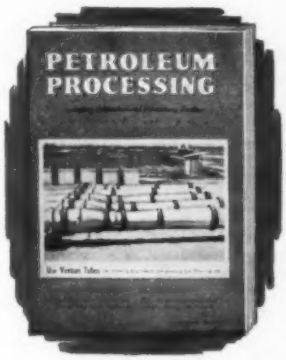
ALUMINUM COMPANY OF AMERICA

LOOK INTO THE FUTURE—LOOK INTO PETROLEUM PROCESSING



Terse and timely...yet thorough

Petrochemicals, the fast growing offspring of the world's fastest changing industry, will make a tremendous new market for all process equipment in the next ten years. Write for free plant directory and market information.



BECAUSE it has demonstrated its ability to save time for readers and still keep them well informed, *Petroleum Processing* has gained a top spot in the reading habits of petroleum and petrochemical processing men.

Technical knowledge, as well as processes and equipment, grows obsolete fast in petroleum processing. So the men who build and operate the high-speed, big volume processing units must have an efficient magazine like *Petroleum Processing:* terse and timely . . . yet thorough.

Petroleum Processing leads the field in this intensive coverage because it has the most experienced editorial staff. Its four top editors have all been with the publication since the first issue and have a combined experience of 71 years with the Platt petroleum publications. Their experience is indispensable in bringing to the reader all of the significant new developments in technology and operating practices—stripped of non-essential wordage. Their experience is essential in converting McGraw-Hill's world-wide business publishing facilities into useful tools for petroleum processing men. It is also essential in training the younger men now being added to the staff.

The thoroughness of technical coverage may be apparent only to our technical readers, but you don't have to be a technologist to recognize the superior format, better layout, more easily read headlines and captions. When you compare editorial quality, don't look for numbers of wordy pages filled with complicated formulas that belong in a textbook. Look for aids to efficient reading and real comprehension of the information vital to the reader, for stories edited to save reading time.

Petroleum Processing is *designed* and *produced* for fast, efficient communications within a fast, efficient industry.

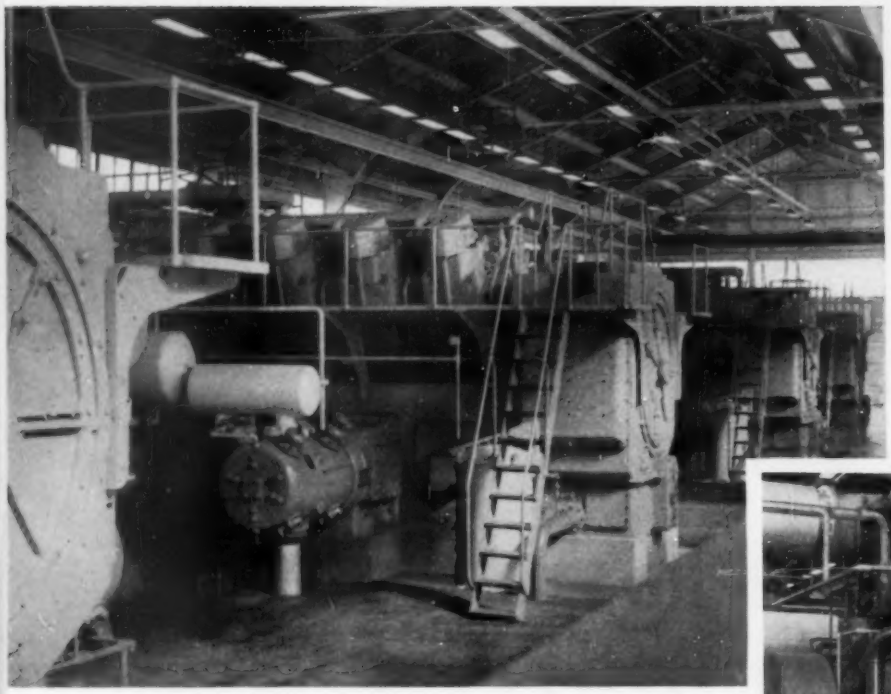
PETROLEUM PROCESSING

NOW McGRAW-HILL PUBLICATION

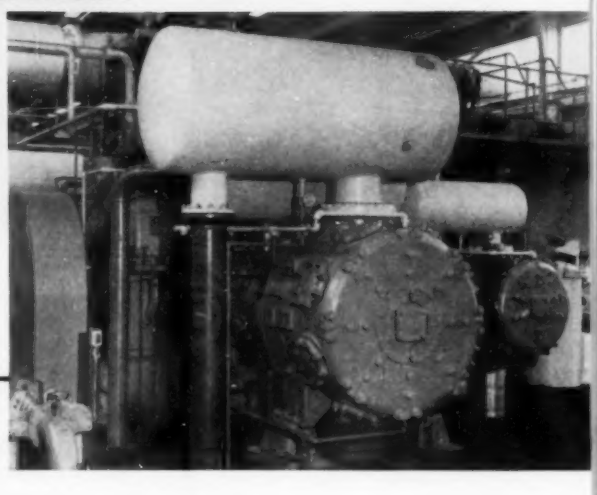
ABP ABC

330 WEST 42ND STREET, NEW YORK 36, N. Y.

Another Example of Efficient Power at Lower Cost



This close-up view of a Cooper-Bessemer GMW clearly shows the neat, simple arrangement of compressor cylinders.



Shown here are the four Cooper-Bessemer compressors, rated 2000 hp at 250 rpm, in Spencer Chemical's modern Vicksburg, Mississippi ammonia plant. These 8-cylinder GMW's compress process streams such as natural gas, synthesis gas, and nitrogen.

HOW SPACE-SAVING GMW'S

Cut Costs in Spencer Chemical's New Ammonia Plant

RUGGED Cooper-Bessemer GMW's handle the compression of natural gas in Spencer Chemical Company's large, new petro-chemical plant in Vicksburg, Mississippi. Combining several unique features, this plant is the first to use partial oxidation of natural gas to produce ammonia.

Although the four Cooper-Bessemer compressors occupy only a relatively small space, they provide an impressive total of 8,000 compressor horsepower. This high horsepower combined with few units means an important reduction in installation time, piping, foundation and building costs.

In operational cost economy, big but compact GMW's at Vicksburg mean long range savings in maintenance, personnel, and overall operating expense.

Add to these features the continued smooth-running performance of Cooper-Bessemer compressors, and you will realize why so many progressive companies rely on V-angles — GMW's, GMV's and GMX's. For additional information, contact the office nearest you.

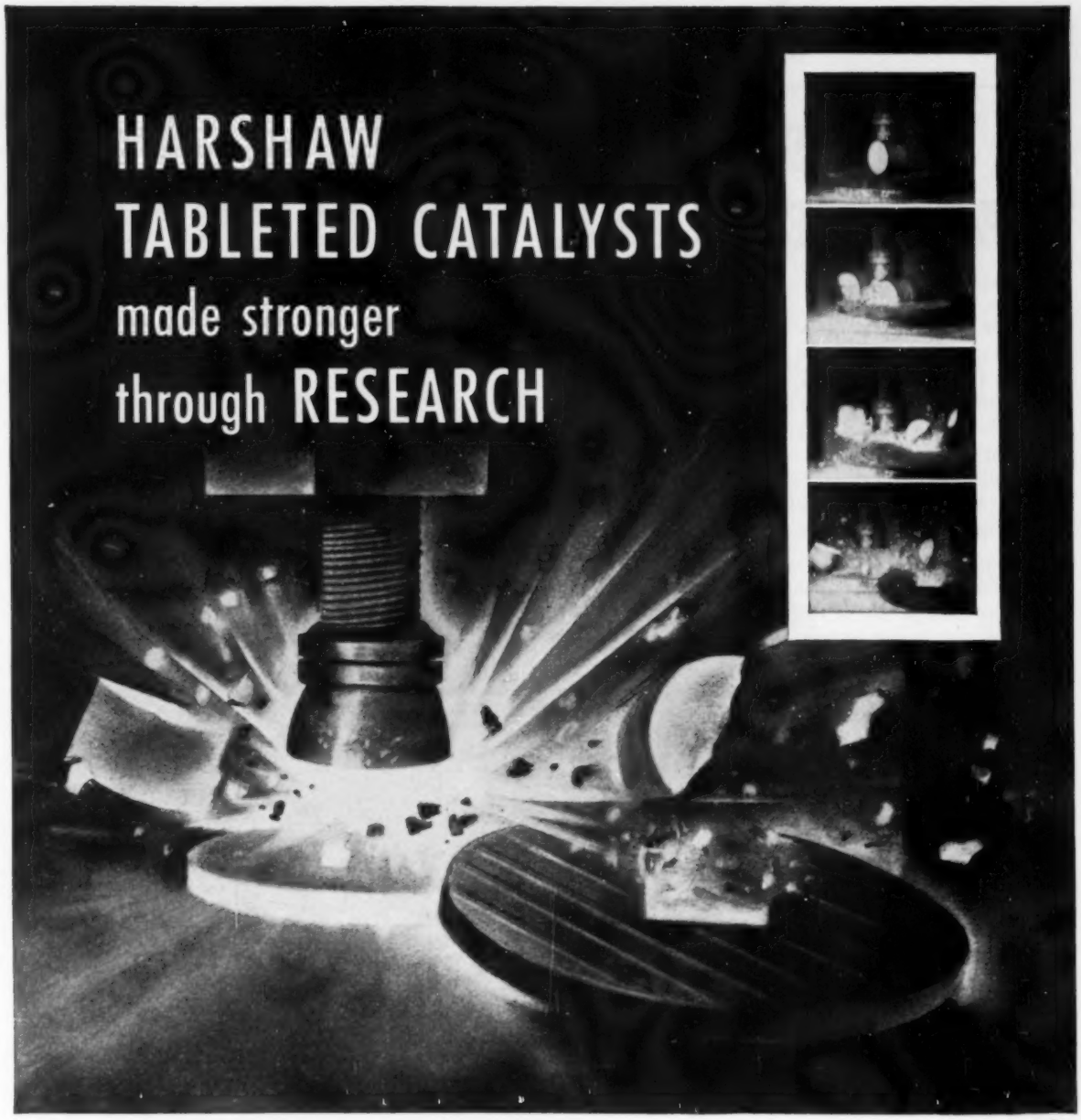
MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS



Rugged Tablets Reduce Reactor Shutdowns

Taken at 1/20,000th of a second, the pictures show a Harshaw catalyst tablet being tested for strength—one step in our research program designed to produce more efficient tableted catalysts having the highest useful strength. Our goal, of course, is to make the catalyst you want and need. First you specify, and then we *produce*.

Tougher, more efficient catalysts mean fewer reactor shutdowns, and, naturally, more economic operation for you. *Harshaw* Catalysts mean fewer reactor shutdowns.

If your mind's on catalysts please contact us today by phone or letter.

Harshaw catalysts available in these forms:

Tablets • Powders • Extrusions • Spheres
Granules • Rings, and Flakes

THE HARSHAW CHEMICAL CO.
Cleveland 6, Ohio

CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH

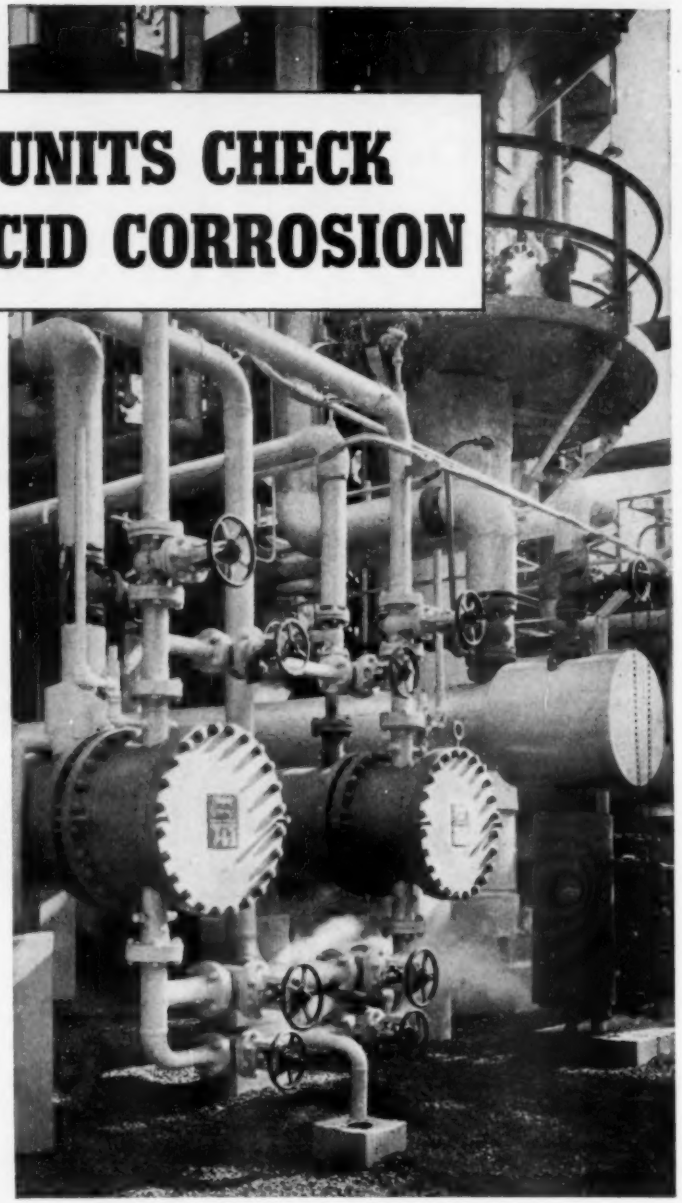
CLAD STEEL UNITS CHECK NAPHTHENIC ACID CORROSION

Corrosion is a constant threat in these naphthenic acid recovery units at a leading eastern refinery. Preheaters handle a mixture of the naphthenic acids, dissolved in a solvent of naphtha and isopropyl alcohol containing sulphuric acid, heating it to 350° F. After stripping, the naphthenic acid distillates—still corrosive—are cooled in a special acid cooler. Operation must be continuous, corrosion protection certain.

Economical stainless clad steel—in the tube sheets, floating head covers, channels and channel covers—stands up to this 24-hour-a-day operation and shrugs off corrosion. A layer of stainless steel—integrally and permanently bonded to a low-cost carbon-steel backing plate—gives all the benefits of the more expensive solid alloy. There is no danger of seepage or crevice corrosion . . . and the chance of equipment failure causing unscheduled shutdowns is greatly reduced.

But economical resistance to corrosion is not the only benefit clad steel equipment offers. The combined teamwork of sound engineering and modern fabricating techniques can take full advantage of the versatility of clad steels. You can look for tanks and pressure vessels that minimize first cost and assure long, trouble-free life . . . give maximum capacity in the least space . . . withstand high pressures and temperatures . . . resist thermal shock . . . permit easy and economical field erection.

You can profit by consulting your fabricators about clad steel's advantages *early* in your planning. Their close teamwork with your engineers and consultants will help give you equipment tailored to your exact processing needs.



Stainless-clad steel provides economical resistance to extreme corrosion in these acid stripping and cooling units.

Ask one of your fabricators to show you the new Lukens clad steel movie, "Equip for New Profits." Here—in full color and sound—are factual accounts of how clad steel equipment brings new economies. The story can suggest new ideas to everyone concerned with production efficiency. Or contact Manager, Marketing Service, Lukens Steel Company, 682 Lukens Building, Coatesville, Pennsylvania.

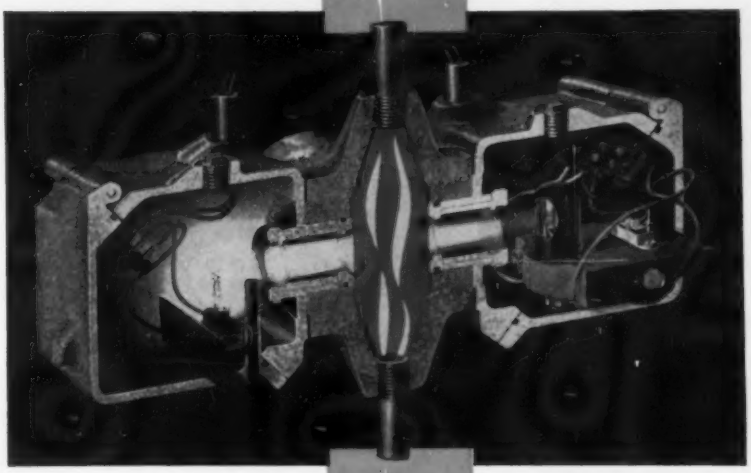
LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEELS AVAILABLE ANYWHERE

Another step in Automation by Beckman

Flow Colorimeter



continuously controls

Fluorescence
Turbidity Color

in plant streams

Three basic elements make up the Flow Colorimeter:

SOURCE A tungsten lamp is the radiation source. Filters select the color of light beamed through the flow cell.

FLOW CELL A stainless-steel casting with windows of ultraviolet-transmitting corex glass handles flows to 7 gpm, pressures to 150 psi. Flow cells can also be glass-lined or made specially from nickel alloys, plastic, etc. Path length can be 1, 2, or 5 centimeters. Openings provide ready access to inside of cell.

RECEIVER A sensitive phototube and exceptionally stable Beckman a-c amplifier measure the radiation transmitted through the flow cell. The amplified signal operates a standard potentiometer recorder. Amplifier circuit components are mounted in three separate plug-in units for immediate on-stream maintenance by regular operating personnel.

Do you have an application in your plant?

- monitoring clarity of liquids
- checking filtrates for filtering efficiency
- monitoring suspended solids
- monitoring nonmiscible drops suspended in a liquid
- determining color intensity

For additional information, write for Data File 90— 23

Beckman *division*

BECKMAN INSTRUMENTS, INC.
FULLERTON 1, CALIFORNIA

"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ SYNOPSIS OF AD #6: The many complexities of the modern processing industries have greatly elevated the importance of the metallurgical engineers and welding technicians of Western Supply Company. These men, working as a team, have guided Western through years of delicate fabrication in the AISI Stainless Steels in the 300 series . . . High Chrome Irons . . . the Refiner's Alloys, the low chrome Moly Steels . . . Monel . . . Copper . . . Copper Silicon . . . . . Nickel . . . Aluminum.

When fouling of heat exchanger tubes and shells is a tough problem . . . you can rely on the special metal design and fabrication experience of Western Supply Company.

seventh in a new series of advertisements

Drilling a hole should be a simple operation. Thousands of work-shop hobbyists do it every day. But in the Western Supply Company plant, drilling a simple hole becomes a science.

These holes, in the stationary and floating tube-sheets must hold the heat exchanger tubes in a vapor or fluid-tight joint. Many tube-sheets have hundreds of such tube holes. A leak in any one, by permitting the mixing of shell-side and tube-side fluids, could prove costly, dangerous or both. To prevent this, TEMA (Tubular Exchanger Manufacturers Association) tube-hole tolerance for normal fit is plus/minus .002 of the specified tube hole diameter. In addition to tube hole diameter, the location of holes and accuracy of ligament between holes as well as tube hole drift are equally important factors.

To assure meeting TEMA specifications, Western's drilling technique is as follows:

1. After tube sheet machining, tube holes are scribed by the layout department.
2. Fully scribed, the hole locations are then carefully center punched.
3. With the completely layed-out tube sheet on the drill press, drill position is exactly established with a dead center tool and the radial drill locked into position.
4. The hole is drilled .015 under final specification.
5. The tube hole is reamed to size, normally .010 plus/minus .002 over nominal tube diameter.
6. All tube holes for Class R equipment have two 1/8" wide by 1/64" deep serrations.
7. All tube holes are chamfered 45° on both sides of tube sheet.
8. Tube sheets are chemically cleaned to de-grease prior to assembly.

That's "The Hole Story" behind every tube hole drilled at Western Supply Company for Western Heat Exchangers.

WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY CO.

P. O. BOX 1888 • TULSA, OKLAHOMA

'ROUND THE CLOCK...
ALL YEAR 'ROUND

Refinery operations are a grueling test of the design and construction of the various complex production units. The continuous, trouble-free performance required of these installations demands that they be engineered right . . . built right.

Pritchard engineers have a well-deserved reputation for cooperating closely with our clients' engineering staffs. This integration produces refinery installations of practical, efficient design that pays off in economical production and Pritchard construction engineers have proved over and over again their exceptional ability at putting these installations on stream on time.

Engineered right . . . built right! Two good reasons to choose Pritchard for *your* next refinery installation.

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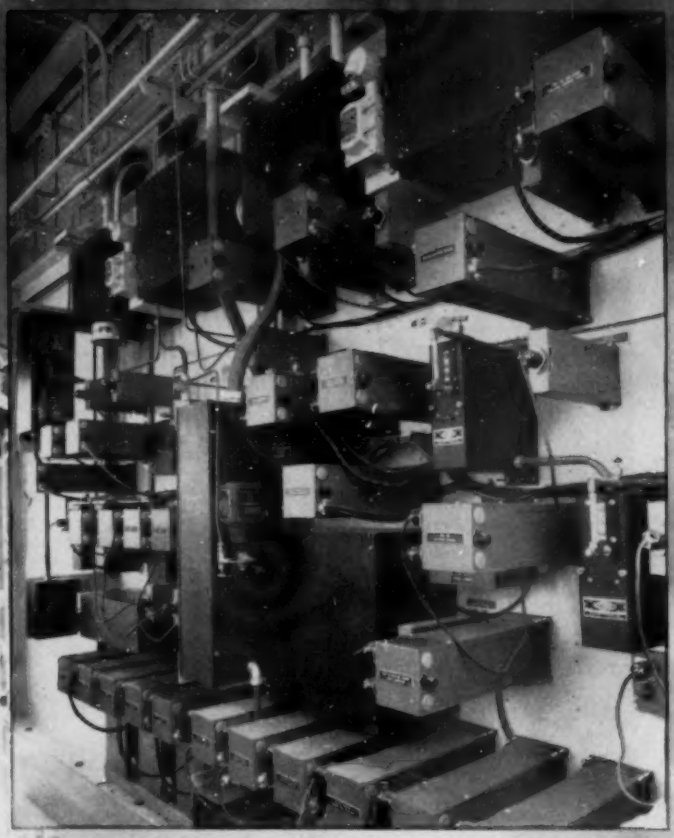


This view shows the back of the graphic control panel and of the electronic instruments for the UOP Platforming unit at the refinery of Rock Island Refining Corporation at Indianapolis, Ind. This Platformer is the first complete refinery unit in the United States to be controlled by electronic equipment.

(*Advertisement*)

Rock Island Refining Corp. Has First Complete Refinery Unit Controlled By Electronics

By L. E. Winkler
President
Rock Island Refining Corp., Indianapolis, Ind.

PROGRESSIVE thinking and action are vital to our refining operations. Since Rock Island Refining Corporation was organized in 1940, we have constantly sought to maintain our position as one of the most modern refineries in the world, dedicated to staying in the forefront of the petroleum refining industry as it produces higher quality products.

L. E. Winkler

Rock Island was the first refinery in the world to install a graphic control panel, a device which since has revolutionized the control of refinery processes. It was also one of the first refineries anywhere to build a UOP "stacked" Fluid Catalytic Cracking unit.

Now Rock Island has scored another "first"—a complete refinery unit which is instrumented by electronics.

The new type of instruments are controlling our 2,400 barrel-per-stream day UOP Platforming unit, which went on stream recently to produce motor fuel blending component. Although the Platformer has been running only a short time, the electronics equipment already has paid dividends through a smoother startup and easier handling.

Our decision to install electronic controls was based on economic factors as well as our desire to keep ahead of the industry in modern refining techniques. We took a long-range look at the potentials of this new type of equipment and ascertained that:

(1) It would increase the reliability of the Platformer's operation in cold weather by eliminating the possibility of freezing up of instrument transmission lines.

(2) It would do away with racks for the pneumatic tubing from the graphic panel to the battery area, thus reducing initial installation costs and problems connected with startup and maintenance operations.

(3) It would result in better control because of the increased sensitivity of electrical impulses.

Controls Work Perfectly

The electronic controls worked perfectly from the very beginning. On the day selected for the startup of the Platformer, oil was put into the unit at 9:30 a.m., and in less than three hours the unit was completely "lined out"—operating smoothly at the desired conditions. In less than two weeks, the unit had fully proved itself and had come to be considered a part of our routine refinery operations. Universal Oil Products Company designed, engineered and licensed the Platformer. UOP's instrument department engineered the installation of the electronic controls.

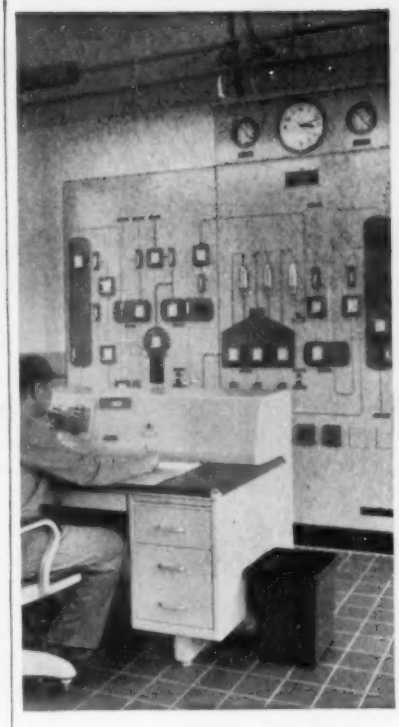
In our instrumentation, transmitters located in the battery area of the Platformer measure temperatures, pressures and flow and convert them to electrical signals. These go to recorders located on the graphic panel and to controllers, also located on the panel.

The controller compares the signals with a signal from the set point mechanism on the recorder that has been set previously by an operator. The controller sends out a current signal to the control valve, causing it to assume a given position. In the event the transmitter signal does not match the set point signal exactly, the controller modifies the current signal to the valve, located in the battery area. At the valve, the current signal is converted to a pneumatic pressure corresponding to the current signal in order to supply the power necessary to position the valve. This causes the valve to either open slightly or close slightly in order to bring the transmitter signal back into line with the set point signal.

Electronic Controls Act Swiftly

We have found that the electronic controls give almost instantaneous response when there are variations in temperature, pressure or flow through the Platforming unit. In addition, there are few moving parts in the equipment, thus reducing maintenance and wear. There is also complete interchangeability of parts, making it as easy to change parts as it is to change a light bulb.

We at Rock Island are proud to be the first refinery in the United States to install complete electronic controls to operate a major processing unit, and we believe sincerely that this instrumentation will go far toward helping us to consistently make better petroleum products from the crude oil that we process.



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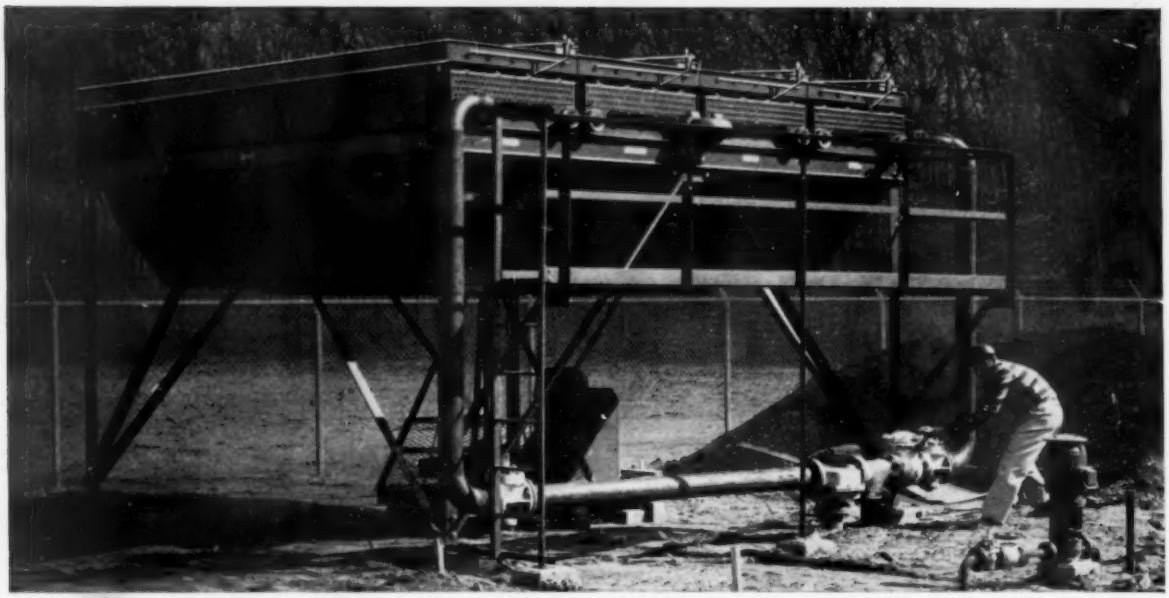


Keep power consumption to a minimum with TRANE Fluid Coolers equipped with two-speed motor and heavy-duty automatic shutters over coil. This GC Series vertical discharge model comes in 8 sizes—fan dia. from 60″ to 216″.

New Trane fluid coolers reduce cooling costs!

Automatic shutters, two-speed fan motor cut operating hp to 35% of design hp. Hold to ±2°F. of desired leaving temperature.

Here's how to cut continuous-duty cooling costs to the bone with efficient TRANE Fluid Coolers. Units have two-speed motor . . . optional automatic shutters . . . blow-through design . . . minimum pressure drop on air side of coil . . . high heat transfer efficiency.

Cut power costs as much as 65%! Two-speed motor and shutters over coil operate automatically . . . together . . . to modulate capacity. Fluid Cooler motor operates at full speed an average of 20% of the time . . . at half speed 80% of the time. When motor runs at half speed, fan hp requirement is only ⅛th that at full speed . . . reduces power costs as much as 65%.

Leaving fluid temperatures held to plus or minus 2°F.—insures maximum operating efficiency from engine or process fluid being cooled.

Blow-through design can reduce power consumption 10%. Fans operate more efficiently because they always handle cooler ambient air.

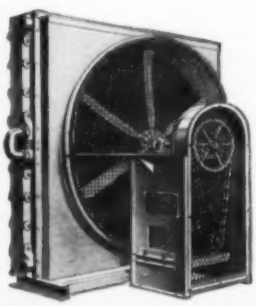
Shutters shipped installed on coil. Heavy-duty TRANE shutters are linked together to operate in unison. Counterbalanced blades have edges formed to interlock for tight shut-off. Full length shutter shafts turn in heavy bronze bearings . . . power is applied equally to both ends of shaft for positive uniform operation.

Protection against freeze-up. With shutters closed, convectional air circulation through coil is halted . . . a major safety feature not found in other designs.

Lower maintenance costs. Shutter controls are simple—rugged—in contrast to complex mechanism needed for variable pitch units. Result: more dependable performance, less downtime.

For full information, call your TRANE Sales Office or write TRANE, La Crosse, Wis., Bulletin DS-395.

Heavy-duty 14 ga. shutters do not warp or twist. Rugged framework of unit resists wind and earth shock.



Model EC horizontal discharge TRANE Fluid Cooler available in 14 sizes; fan dia. from 18″ to 90″. Shutters optional.

TRANE fluid coolers

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn.
Trane Co. of Canada, Ltd., Toronto • 90 U. S. and 14 Canadian Offices

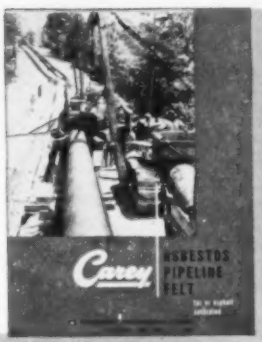
If YOUR JOB INVOLVES

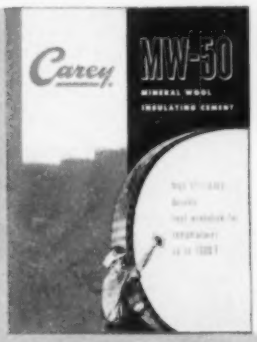
- oil or gas pipelines
- processing operations
- refinery construction or maintenance...

You need this helpful literature!

Asbestos pipeline felt data book...

a discussion of protective coatings for pipelines by a competent corrosion engineer. Covers the fundamentals of low cost, dependable pipeline protection. Timely, informative, fully illustrated.



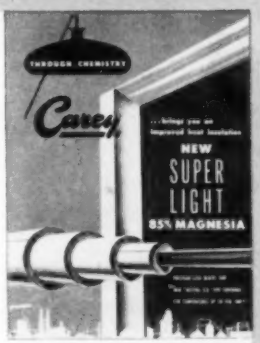


Carey MW-50 data book...

describes the most modern method for insulating all types of heated equipment having temperature ranges up to 1600°F., and gives details for applying insulation on irregular or hard-to-reach surfaces.

Super-Light 85% magnesia data book...

description, specifications and recommended uses for a new, improved insulation in precision-sized monolithic blocks, molded pipe coverings and cements.



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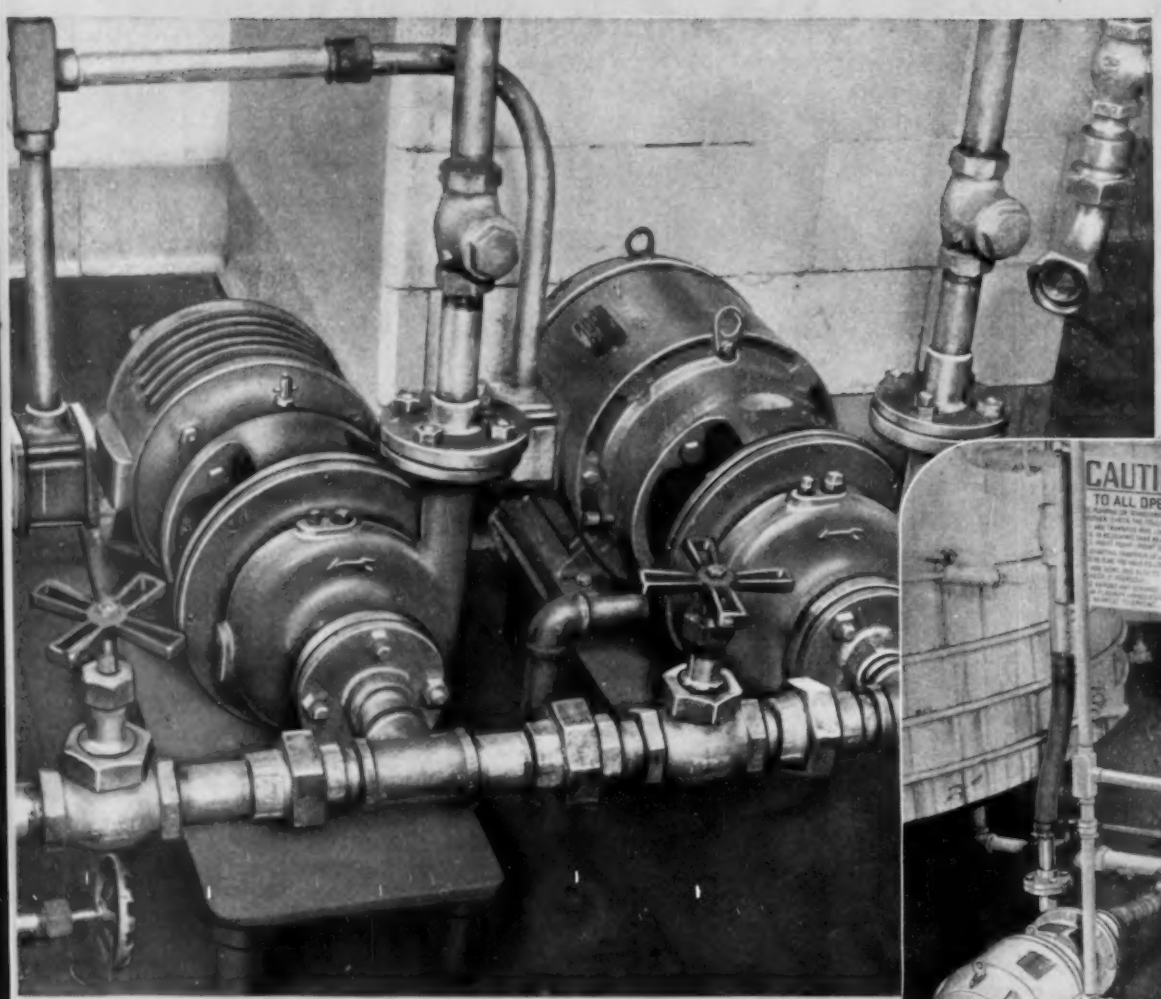
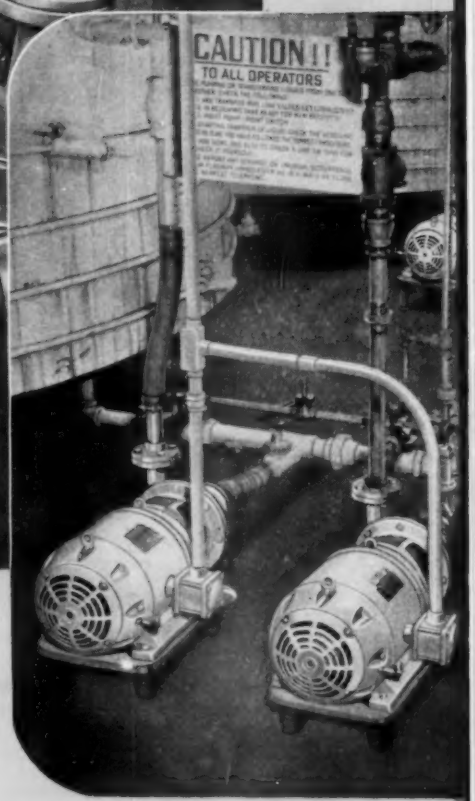
Seven reasons why Kraft Foods Co. uses.





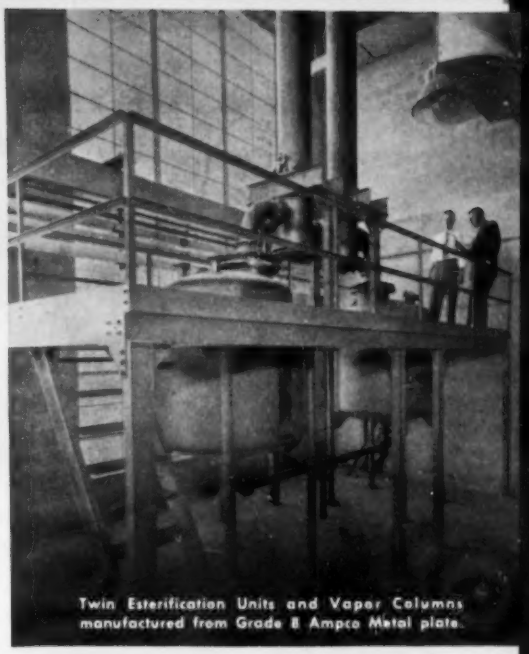
Ampco Centrifugal Pumps, made of Illium "G", pumping vinegar to automatic measuring devices in the Mayonnaise and Miracle Whip Processing Dept., Kraft Foods Co., Chicago, Illinois.

Ampco Pumps are available in most workable alloys. When made from corrosion- and wear-resistant Ampco Metal, they give you all the advantages of a special pump at standard pump prices.

Ampco Pumps handling vinegar from tank cars to storage, Kraft Foods Co., Chicago.

Outside and internal sections of a 10" Barometric Condenser.

AMPCO* CENTRIFUGAL PUMPS



Twin Esterification Units and Vapor Columns manufactured from Grade 8 Ampco Metal plate.

1. Good corrosion-resistance
2. Low capital investment
3. No metal-to-metal contact
4. High efficiency
5. Constant rate of flow
6. Durametallic seals that resist wear — are easy to replace
7. Small space requirements

KRAFT uses corrosion-resistant Ampco Centrifugal Pumps to handle the vinegar used in the production of its mayonnaise and salad dressing. These pumps give a dependable flow rate . . . freedom from contamination . . . greater dependability . . . less downtime.

Moreover, Ampco Pumps are used throughout industry for difficult liquid-handling problems. They represent pump design at its best — both hydraulic and mechanical. They save power — have wide performance range, good characteristics, high efficiencies (up to 85%). They save money — you get a special pump at a standard pump price. They're built of Ampco Metal — the special alloys that make good where other metals fail. That's why they're unusually resistant to wear, corrosion, erosion, cavitation-pitting, and deformation. That's why you get a pump that will successfully handle abrasive solids in suspension, or viscous liquids.

Best of all, Ampco Pumps are production-built, competitively-priced in a wide range of sizes. You can get them not only in Ampco Metal, but also in Illium "G" or other workable alloys to meet the requirements of unusual jobs.

Put these standard units to work for you — give them the tough jobs that formerly required high-priced special pumps. Take advantage of low-cost, long-life, headache-free pumping. Check with your nearby Ampco distributor or write us for the solution to your difficult fluid-handling problems.

Sulfuric acid sludge tank, made of Grade 8 Ampco Metal plate under construction at large Pacific Coast Refinery.

*Reg. U. S. Pat. Off.

Attach this coupon to a postcard and mail today.

Illium "G" is the registered trademark of the Illium Corporation

Ampco Metal, Inc.

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West Coast Plant
BURBANK, CALIFORNIA

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AMPCO METALS, INC., Dept. PP-11, Milwaukee 46, Wisconsin

☐ I'm interested in Ampco Centrifugal Pumps. Send me bulletin No. P-3a.

☐ I'd like to know more about Ampco Metal for use in process industries. Send me more information.

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Company Address.....

City..... (.....) State.....

PR-14

Where *is "Lead" used*

to control Sulphuric Acid Corrosion?

Find H_2SO_4 and you're apt to find lead.

Lead's fought H_2SO_4 corrosion for several centuries and its usefulness grows steadily.

The past few years have seen lead go into new types of electrostatic and sonic air purifiers; into new waste treating equipment; bubble towers; devices for processing, recovering and storing sulphuric acid and other chemicals.

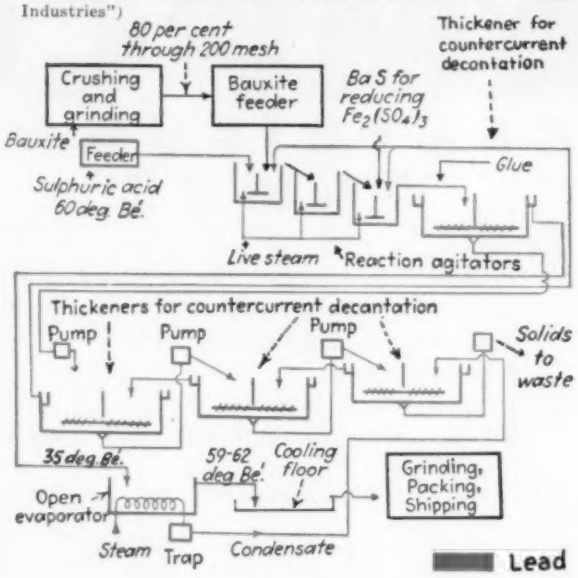
And new forms of cage-type sheet lead structures have been developed... along with new bonding and strap lining methods, new constructions for high temperature erosion-corrosion service, automatic stud welding. New, non-destructive tests for bonds, linings and welds have been devised.

More is coming soon... coming from research into anodic corrosion of lead in sulphuric solutions ... into lead's age hardening and creep properties ... into unknowns.

What about lead in your own acid handling equipment... considered in the light of this new lead technology? It's worth thinking about, and...

Aluminum sulphate.

(From Lee's "Materials of Construction for Chemical Process Industries")



When you think of Lead...

think of National Lead

WHAT GOES FOR LEAD AND H_2SO_4 GOES FOR LEAD AND HUNDREDS OF OTHER CORROSIVES

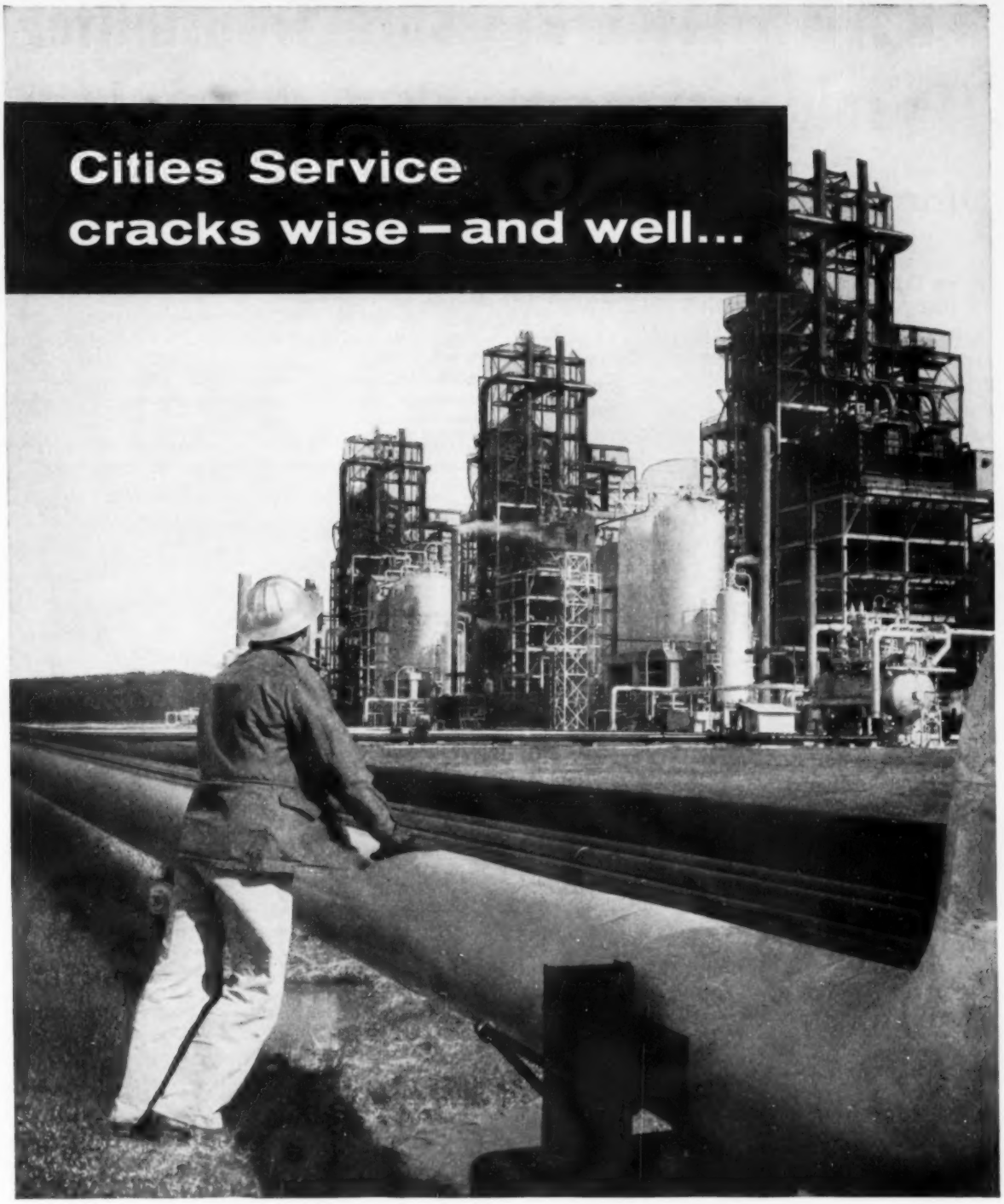
National Lead puts lead in your hands in any grade you may require and in every conceivable form—sheet, pipe, coils, fittings, valves, pumps and vessels. Or you can have National Lead fabricate lead equipment to your specifications.

So put National Lead first in your thinking when you want to combat corrosion. Call on National Lead for technical assistance. Ask for a copy of the new booklet on "Chemical Lead Products."

*Reg. U. S. Pat. Off.

National Lead Company

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Ltd.).



These three catalytic crackers dominate the skyline of our Lake Charles, Louisiana, refinery which normally processes 175,000 barrels of oil every day.

CITIES SERVICE

A Growth Company

TRANSAIRE® Pressure Transmitter solves these tough problems!

Measuring within ½% of 20-40 psi shiftable range spans

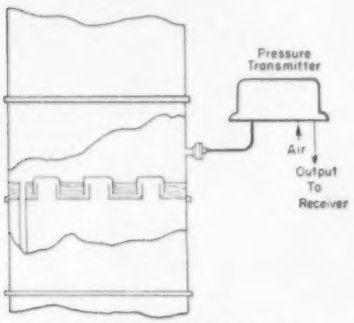
THE Taylor TRANSAIRE Pressure Transmitter with short, shiftable spans gives unprecedented accuracy and sensitivity—plus the convenience of suppressed ranges at high pressure levels. Operating on the simple force-balance principle, it will measure and transmit minute pressure changes up to 1,000 ft. It's accurate to ½% of the selected short range span and sensitive to pressure changes of ½" water.

THREE IMPORTANT ADVANTAGES

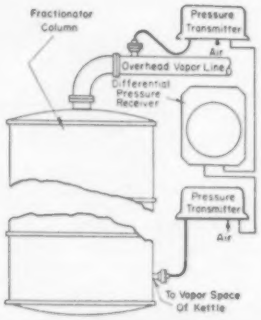
1. Range spans of 20 and 40 psi are available throughout the range limits of 35 to 415 psia; 50 to 100 psi throughout 100 to 1,000 psia.

2. The volumetric type pressure system is extremely accurate, practically clog-proof, has a corrosion-resistant 316 stainless steel diaphragm.

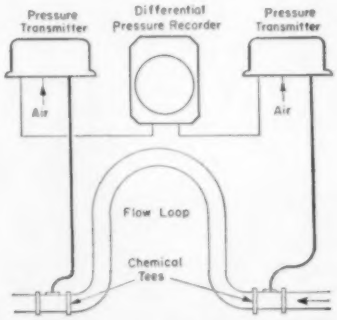
3. Temperature and barometric compensation make for higher accuracy of measurement, and consequently closer control.



COLUMN PRESSURE



COLUMN PRESSURE DROP



FLOW OF VISCOUS LIQUORS

NARROW RANGE SPAN DETECTS PRESSURE TRENDS

Problem: To get highest possible purity of product consistent with good production economy. This requires the quick detection of pressure trends over a very narrow range.

Solution: The short, shiftable range spans (as short as 20 psi) of the TRANSAIRE Pressure Transmitter permit selection of operating range by a simple screw-driver adjustment. Its high order of sensitivity enables the operator to detect minute changes of pressure.

Result: Close control, because the minute pressure trends are practically instantaneously detected and transmitted to the controller and receiver. This means higher yield of a purer product, also great flexibility in changing to different product requirements.

PERMITS MAXIMUM CAPACITY OPERATION

Problem: To operate a column at maximum capacity, consistent with the preventing of flooding.

Solution: As the pressure drop across the column is a measure of the vapor velocity, the measurement of this drop with a short-range, highly sensitive, easily adjustable instrument enables the operator to keep the column safely close to the flooding point.

Result: Maximum production and uniform operation.

STREAMLINED SURFACE PREVENTS SCALE, SOLIDIFICATION

Problem: Flow measurement of viscous material which tends to solidify when static, making conventional differential producers impractical.

Solution: Its flush element presents a streamlined surface and tends to prevent formation of scale or solidification of liquors. Its short range, high sensitivity and volumetric construction makes the TRANSAIRE Pressure Transmitter ideal for this application.

Result: Trouble-free, accurate measurement and control of flow. One installation has given continuously satisfactory service for four years.

Ask your Taylor Field Engineer, or write for **Bulletin 98097.**
Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Taylor Instruments MEAN ACCURACY FIRST

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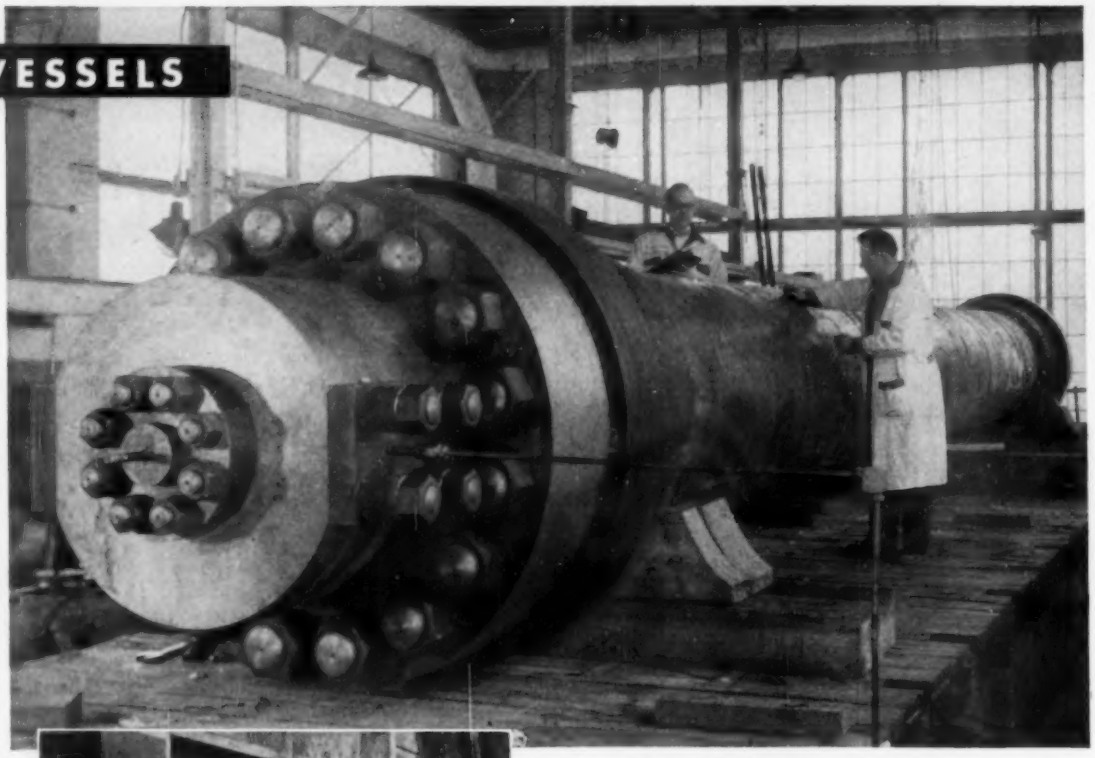


Photo shows MULTI-LAYER ammonia super-pressure converter on test at A. O. Smith. Inside vessel diameter is 25¾ in. . . . length from one flange face to the other is 44 ft. 3 in. . . . weight 238,000 lbs. Vessel is designed for operating pressures of 12,500 psi at a temperature of 450° F.

A. O. Smith technician checks gauges on converter undergoing pressure tests. The giant vessel is being tested out at 18,750 psi.

If your process involves high

DESIGN

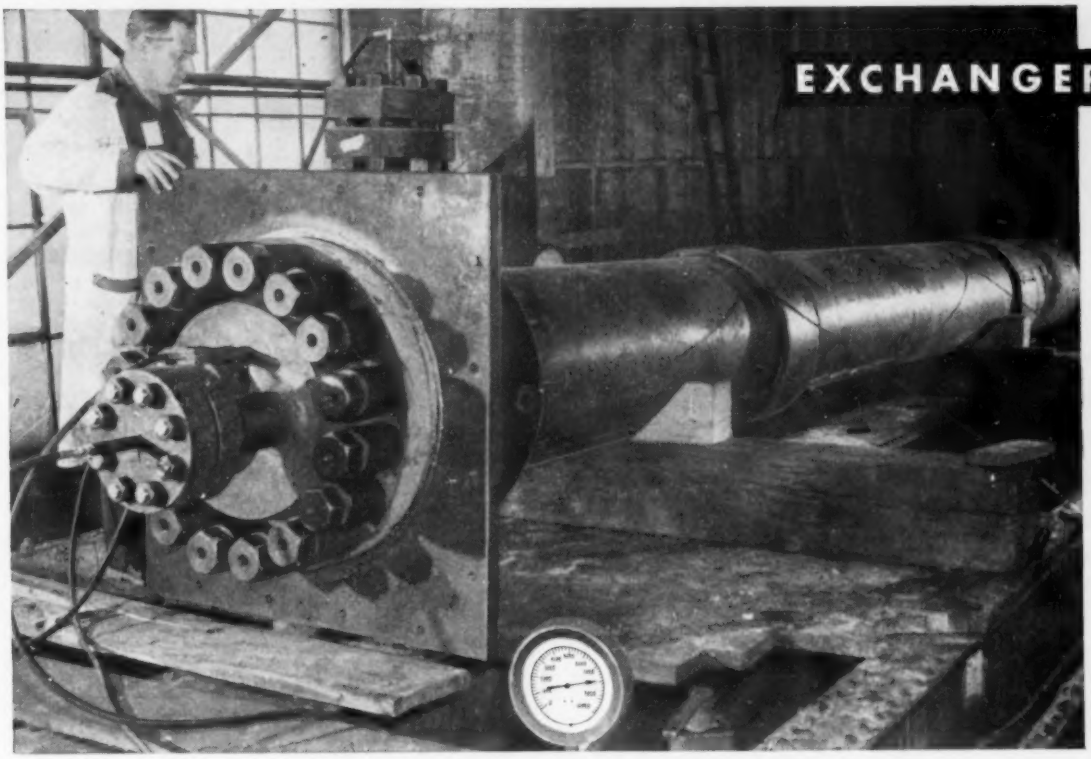
THE ANSWER TO THE HIGHER PRESSURES WITH SAFETY

A. O. SMITH MULTI-LAYER construction offers significant advantages to the men who operate plants or design equipment for the processing industries. Today . . . right now . . . they can design for the higher pressures that will be required in the future.

In MULTI-LAYER construction, successive concentric layers of relatively thin steel plate are wrapped and welded around a central pressure-tight cylinder. There's no limitation of size or weight . . . no restrictions imposed by ingot size or forming techniques. The variations are endless.

Positive safety under pressure, too! By testing to destruction full-scale vessels at pressures in excess of

Outstanding Advantages



Here's a Multi-LAYER recycle heat exchanger undergoing test pressure of 7,920 psi. Inside diameter is 17 in. . . . MULTI-LAYER wall thickness is 3⅜ in. . . . overall length 29 ft. 2 in. Weighing 31,200 lbs., this exchanger is designed for shell-side operating pressures of 5,280 psi.

pressures, high temperatures or corrosive materials,

WITH MULTI-LAYER

40,000 psi, A. O. Smith has proved that MULTI-LAYER vessels burst without fragmentation.

Pick the alloy lining required to fit your needs! MULTI-LAYER vessels can be fabricated with inner cylinder of lined or clad plate, alloy steel or non-ferrous materials. The outer layers of the vessel can then be fabricated of high strength steel to resist the pressure loads.

Let A. O. Smith engineering and research help you adapt MULTI-LAYER vessels and heat exchangers to your operation.

Write for free bulletins: "MULTI-LAYER Manufacturing and Assembling" . . . "MULTI-LAYER Engineering for Safety."

Through research A.O. Smith *. . . a better way*

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PROCESS EQUIPMENT DIVISION

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For glass-lined process equipment, contact GLASCOTE PRODUCTS, INC., Cleveland 17, Ohio — A new A. O. Smith Subsidiary

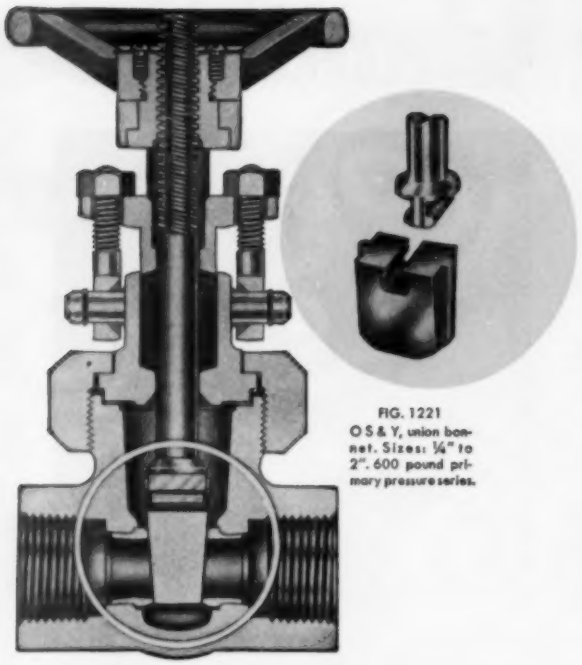


FIG. 1221
O S & Y, union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

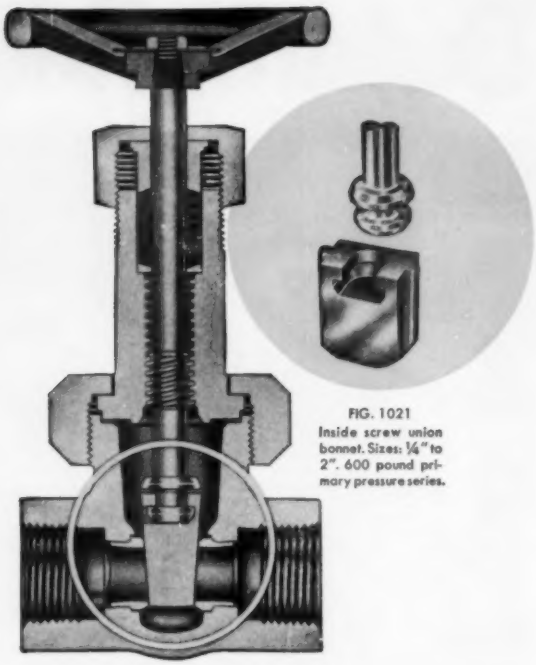


FIG. 1021
Inside screw union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

New design makes OIC forged steel gate valves the most modern line . . .

NEW: stronger stem-to-wedge connection. Improved, modern design increases pull-out strength to many times the theoretical requirement. This design distributes the pull-out load more efficiently throughout the wedge structure to meet the most stringent specifications of valve buyers in all fields.

NEW: wedges wear longer. Wedges are made of 13% chrome stainless steel for corrosion resistance. They are duracased to at least 1000 Brinell Hardness to prevent galling and excessive wear caused by frequent closures upon foreign particles in the flow.

NEW: union bonnet design is more efficient. Body-to-bonnet joint of the male-female type provides a recess for the gasket. It is contained more securely, reducing the possibility of leakage or a blown gasket.

OTHER OUTSTANDING FEATURES

Stem threads of all OIC inside screw, forged steel valves are always contained inside the bonnet. They can't possibly load up with corrosive matter which might be in the flow. This keeps the threads clean and free running, and contributes to longer stem wear.

Modern OIC Seal-Ever packing is a special composition which eliminates electrolytic action between the stem and the packing. This prevents stem corrosion in the packing area and helps maintain a leakproof seal.

Back-seating feature provides means of repacking valves while in service.

OS & Y valve gland "I" bolts are retained on trunnions by modern, more efficient, stainless steel snap rings.

Shoulder-type seat rings are expanded into the body under heavy pressure. They are accurately machined to mate tightly with the wedge for a positive seal.

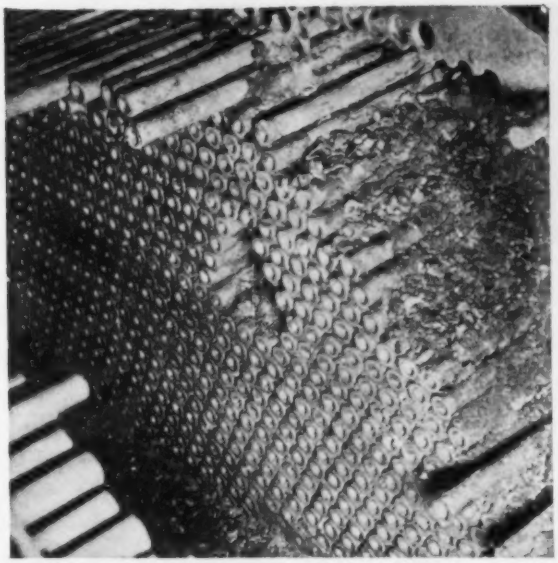
Order modern OIC Forged Steel Valves from your nearby OIC Distributor. Write and request Folder No. 195.

OIC Forged Steel Valves are also available in globes, angles and checks in a variety of trims for any service.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1883 VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON**

POLYRAD STOPS THIS



LOST EQUIPMENT—Cross-section view of a condenser bundle knocked out of service by corrosive attack. Polyrad can help prevent such loss.

LOST TIME—This fouled condenser bundle also cost money to clean. Polyrad's detergent action prevents the formation of organic and inorganic deposits, permits their removal in fluid stream.

There's no longer any reason for frequently cleaning or replacing corroded condenser bundles. Now, through Polyrad's chemical control of fouling and corrosion, this common cause of increased operating costs can be eliminated.

A filming amine inhibitor, Polyrad forms a protective molecular shield that controls the corrosive action of organic and inorganic acids. Throughout the refinery, Polyrad helps maintain throughput, increases heat transfer, reduces metal loss, and cuts down time for maintenance. Fouling is prevented by Polyrad's detergent action, which loosens iron sulfide and other scales to permit their removal in the fluid stream.

Polyrad is readily available from stocks maintained throughout the nation. A Hercules technical representative will be glad to help you evaluate what Polyrad can do for you under your specific operating conditions. For additional data, write Hercules.

Naval Stores Department

HERCULES POWDER COMPANY
INCORPORATED

984 Market St., Wilmington 99, Del.

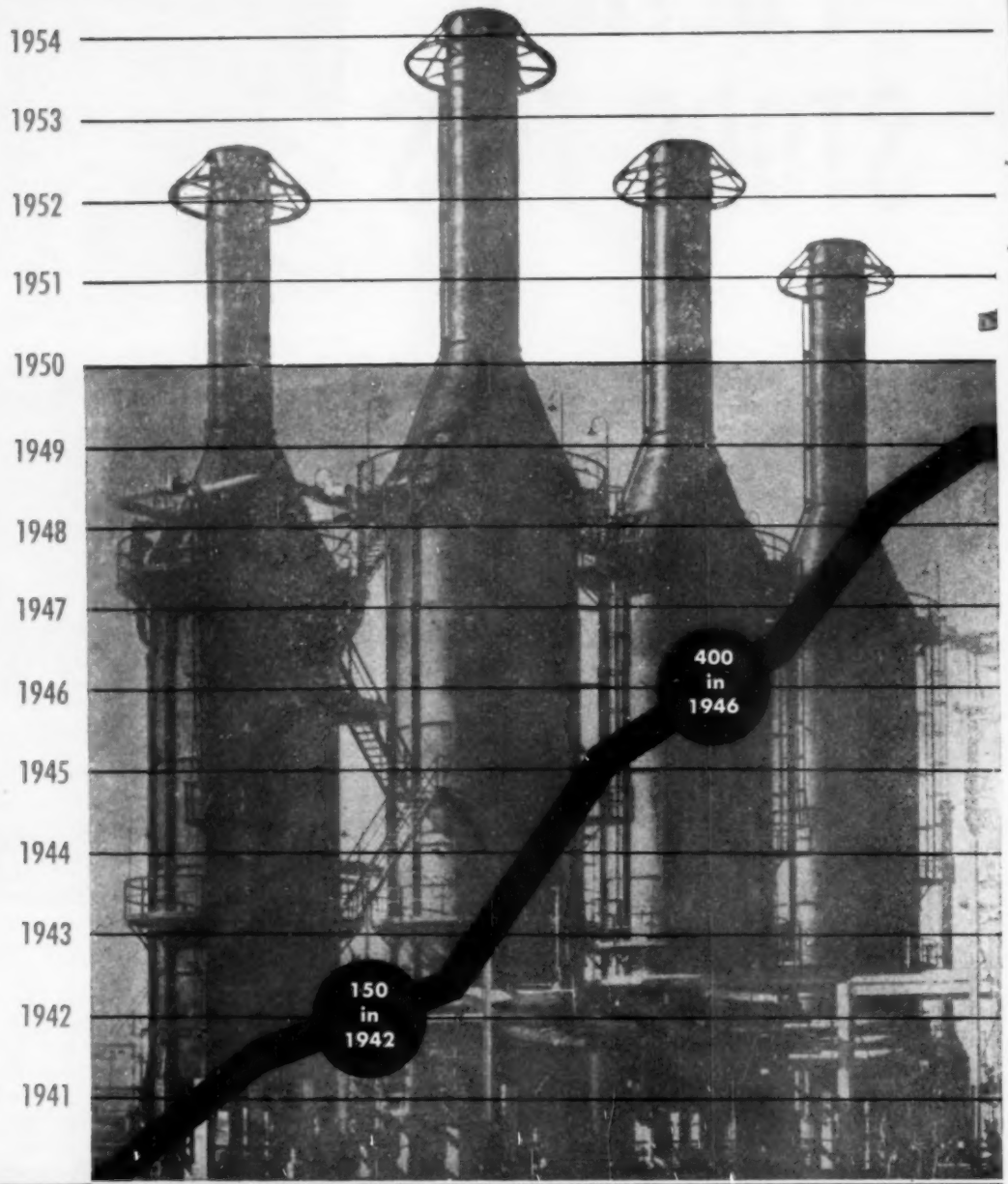
POLYRAD®

FILMING AMINE INHIBITOR

NA54-7

MORE THAN

1210 PETROCHEM-ISOFLOW

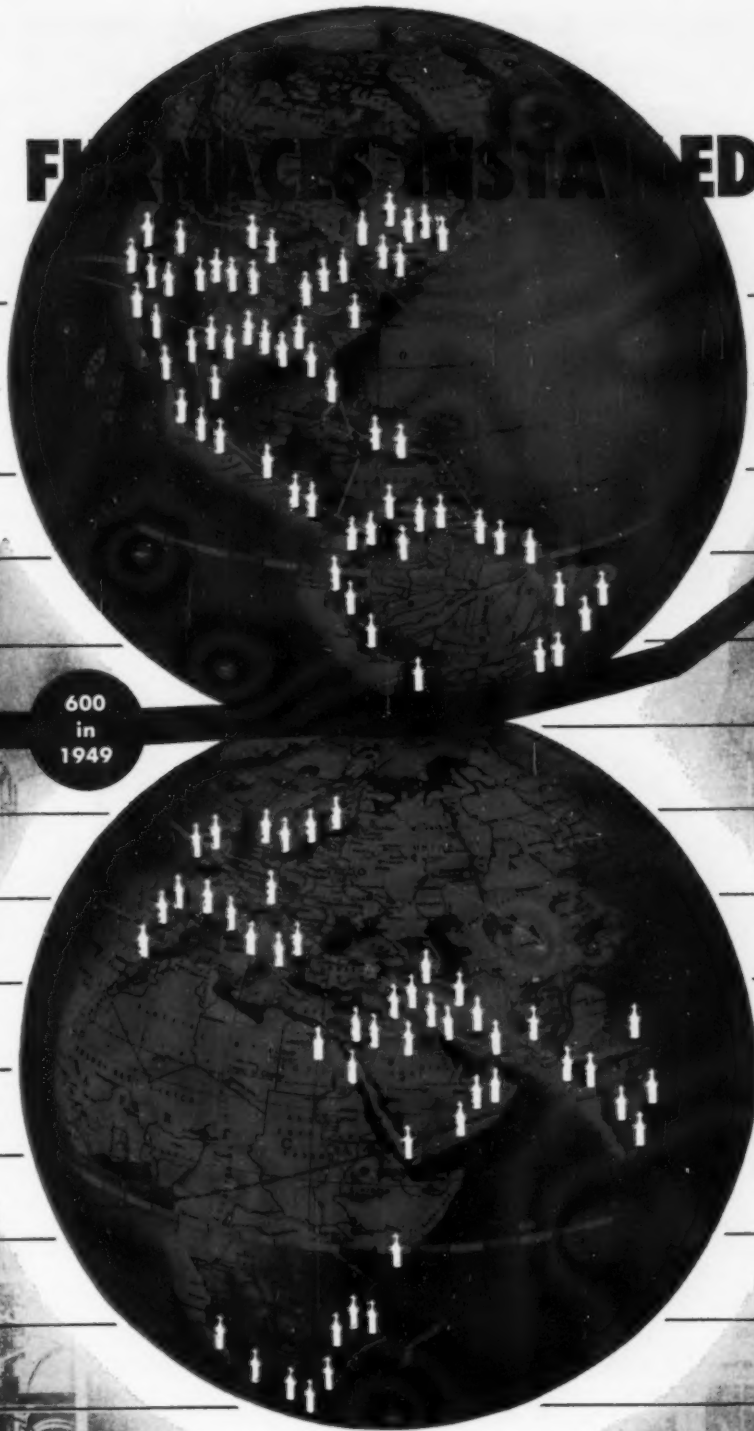


In 1940 there was ... 1
In 1944 there were ... 215
In 1948 there were ... 500
and as of today
there are more than 1210

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

F[illegible]NACES INSTALLED SINCE 1940



...it takes more than a theory to build a record –

MORE THAN 1210 PETROCHEM-ISOFLOW installations are proof of their extraordinary values... proof that whenever you see a PETROCHEM-ISOFLOW furnace you'll find operating performance most efficient by any comparison.

PETRO-CHEM DEVELOPMENT CO., INCORPORATED 122 East 42nd St., New York 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholtz, Los Angeles • Gordon D. Hardin, Louisville • Turbex Equipment Co., Norberth, Pa.

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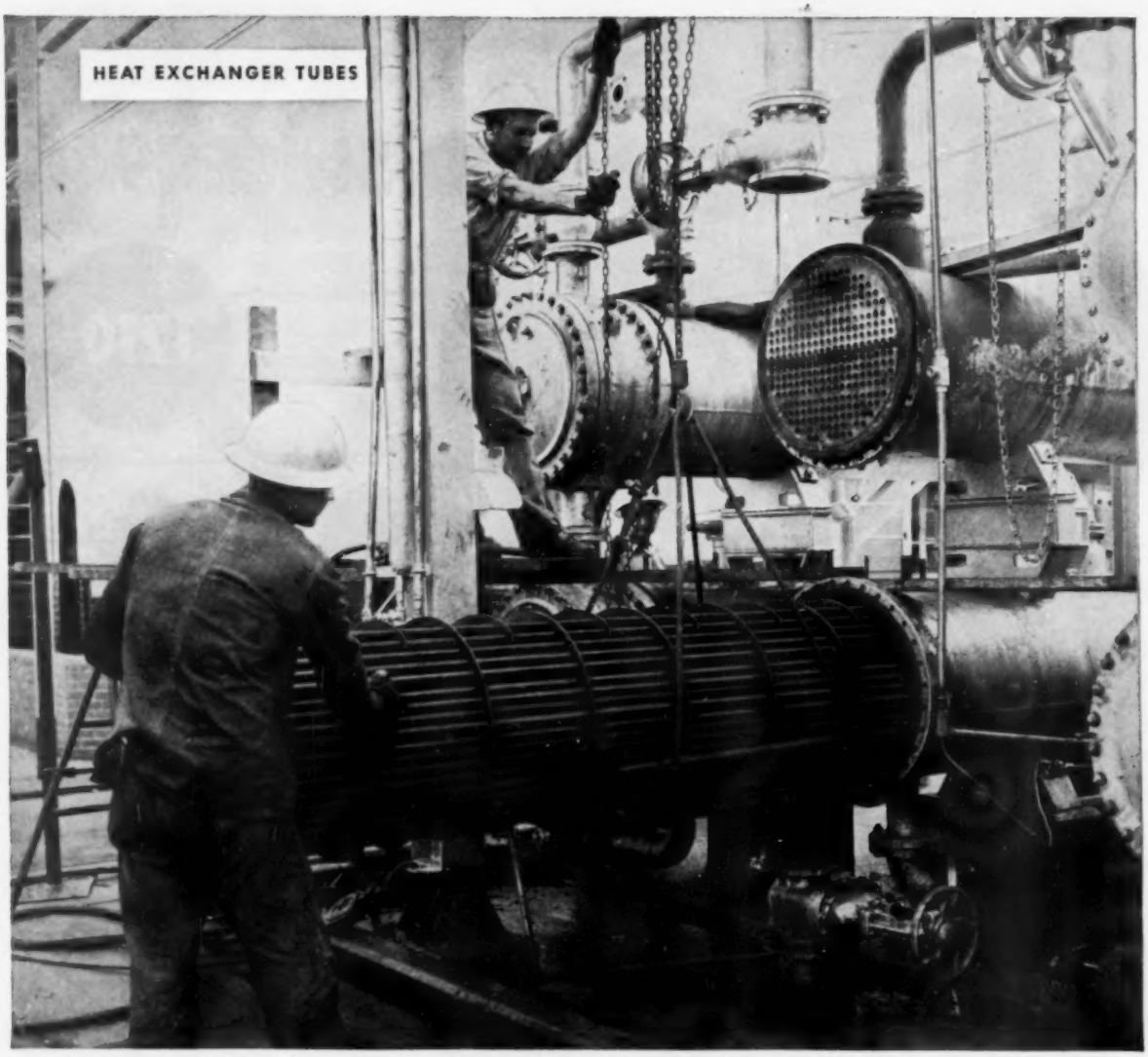


PERFORMANCE RECORD of these tubes under actual operating conditions is now a part of Anaconda's extensive collection of case histories.

Use of Anaconda Cupro Nickel, 10%-755 Tubes in Texas refinery may answer your tube problem

Imagine a collection of tube performance case histories that can answer many of the corrosion problems you face!

Our files bulge with such a collection. Here is experience accumulated over almost a century. Here are detailed records of tube performance under hundreds of actual operating conditions.

We can put the information in these files to work for you at once—to help you select the one best alloy for your job.

Here's a case history we are now adding—the use of ANACONDA Cupro Nickel, 10%-755* Tubes in the Port Neches Refinery of a major oil producer.

These tubes—in use two years—cool heavy gas oil in an Alco Exchanger on a Crude Pipe Still Unit. Gas oil at about 500°F.—mildly corrosive—comes in contact with the outside of these tubes. Brackish river water—with a high salt content—circulates through the tubes. Yet the tubes show no sign of corrosion.

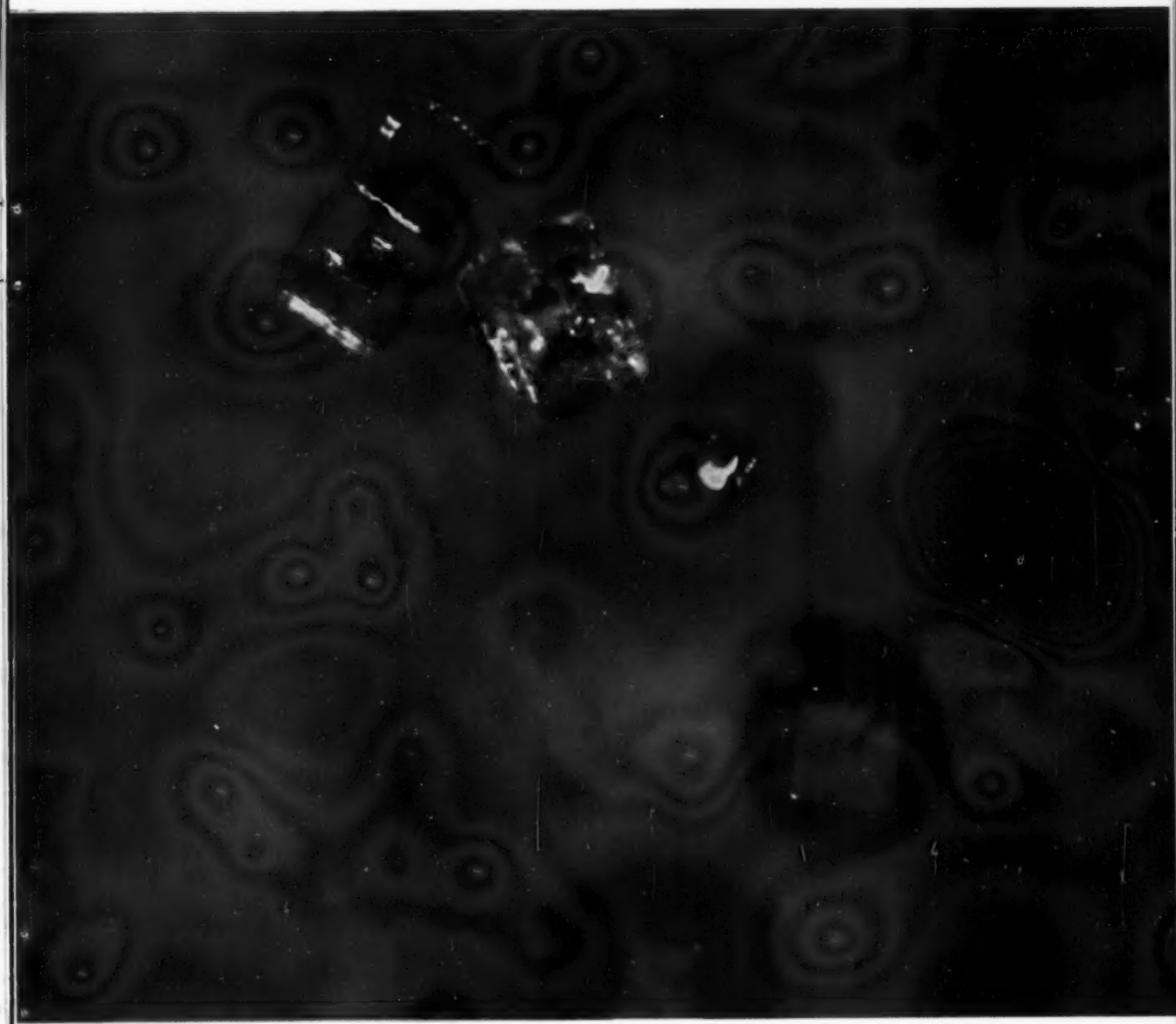
CUPRO NICKEL, 10%-755 resists corrosion almost as well as Cupro Nickel, 30%-702; yet it costs much less. Polluted sea water and sea water with entrained air—even at relatively high velocity—have little effect on this alloy.

Help for your tube problem. No one tube alloy serves best under all conditions. Your problem is one of choosing the right alloy for the job. Let Anaconda's Technical Department help you. Write, outlining your operating conditions, to Dept. TD, *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

*U.S. Patent No. 2,074,604 54109

ANACONDA®
Tubes and Plates
for Condensers and Heat Exchangers

A beautiful picture...OF TROUBLE



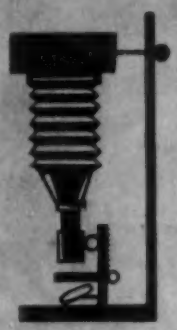
Photomicrograph by J. G. Suthard

The above photomicrograph shows salt crystals in crude oil, magnified to seventy times actual size. When salts such as these get into refinery equipment, the picture isn't so pretty. Salts in the crude charge invariably result in a substantial decrease in refining efficiency. The only protection against them is effective desalting. You get it, with

PETRECO®

ELECTRIC DESALTING

D54-1



The photomicrograph on the reverse of this page was made as a routine step in Petreco's never-ending study of salts in crude oil and their effects on refining operations. When you consider the merits of a desalting process, it is well to give considerable thought to the calibre of the organization offering the process. Petreco pioneered electric desalting and can back Petreco processing with the know-how resulting from nearly half a century of electric processing experience.

Petreco desalters guard your refinery, day and night, against shutdowns caused by salts, solids and BSandW in the crude charge. You can't get better protection, because you can't get better desalting.

ELECTRIC PETROLEUM PROCESSING

DESALTING • DEHYDRATING

SEDIMENT SEPARATING

DISTILLATE TREATING

DESAPONIFYING

For prompt service, or complete information on Petreco processing, call or write

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D54-1

When something's got to give
to compensate for expansion,
contraction, vibration, rotation or strain,
in your piping system or equipment,
it will be far, far better for you
if the "something" that gives
is a Zallea Expansion Joint
and not your expensive piping.
Since piping damage usually
means down-time, it pays
to provide positive, over-all protection.

The expansion joints illustrated,
duo-equalizing, hinged, and universal,
are just a few of the Zallea family
of expansion joints available
to help solve your piping problems.

Regardless of piping movement,
whether axial, lateral, rotational,
etc., Zallea already has, or will
design, an expansion joint to absorb it.
For information on standard types,
request Bulletin 351. For consultation
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Zallea
expansion joints

ZALLEA BROTHERS, 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

Bingham STUFFINGBOXLESS PUMPS

HANDLE LIGHT HYDROCARBONS* AT HIGH SUCTION PRESSURES

NO STUFFING BOX! NO PACKING!

Bingham Stuffingboxless Pumps are successfully handling liquids having high vapor pressure, requiring high suction pressure and, frequently, abnormally low pumping temperature (—300°).

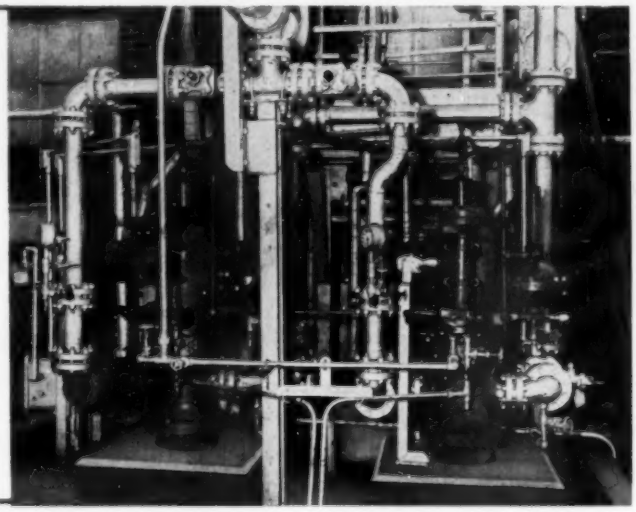
Standard models handle suction pressures up to 2,000 psi (higher pressures available). Pumping temperatures to 850° F. and higher also can be handled.

Bingham Stuffingboxless Pumps are in service today all over the world, with distinguished records in reliability, continuity of service, and low maintenance. Write to your nearest Bingham office for Bulletin 107 or for additional information.

*And other volatile liquids.

BINGHAM STUFFINGBOXLESS PUMPS OFFER:

- Lower overall installed cost
- Less operating attendance
- No misalignment of moving parts
- Smooth operation
- No auxiliary lubricating system
- No exposed moving parts
- Positive motor cooling
- All parts are accessible



FIREPROOF AND EXPLOSION-PROOF! Leakage of vapor to atmosphere or leakage from outside into pump is impossible. Not only is plant and personnel protected, but loss of valuable pumpage is prevented. Type KT Multi-Stage Stuffingboxless Pump illustrated.

Bingham Type KT Stuffingboxless Pumps handling liquid propane under high suction pressure at Esso Standard Oil Company refinery, Bayway, New Jersey.

Bingham SINCE 1921 — DOUBLE VOLUTE PUMPS — RADIAL BALANCE

BINGHAM PUMP COMPANY

General Offices: 2800 N.W. Front Avenue, Portland 10, Oregon

Factories: Portland, Ore. • Vancouver, B.C., Canada

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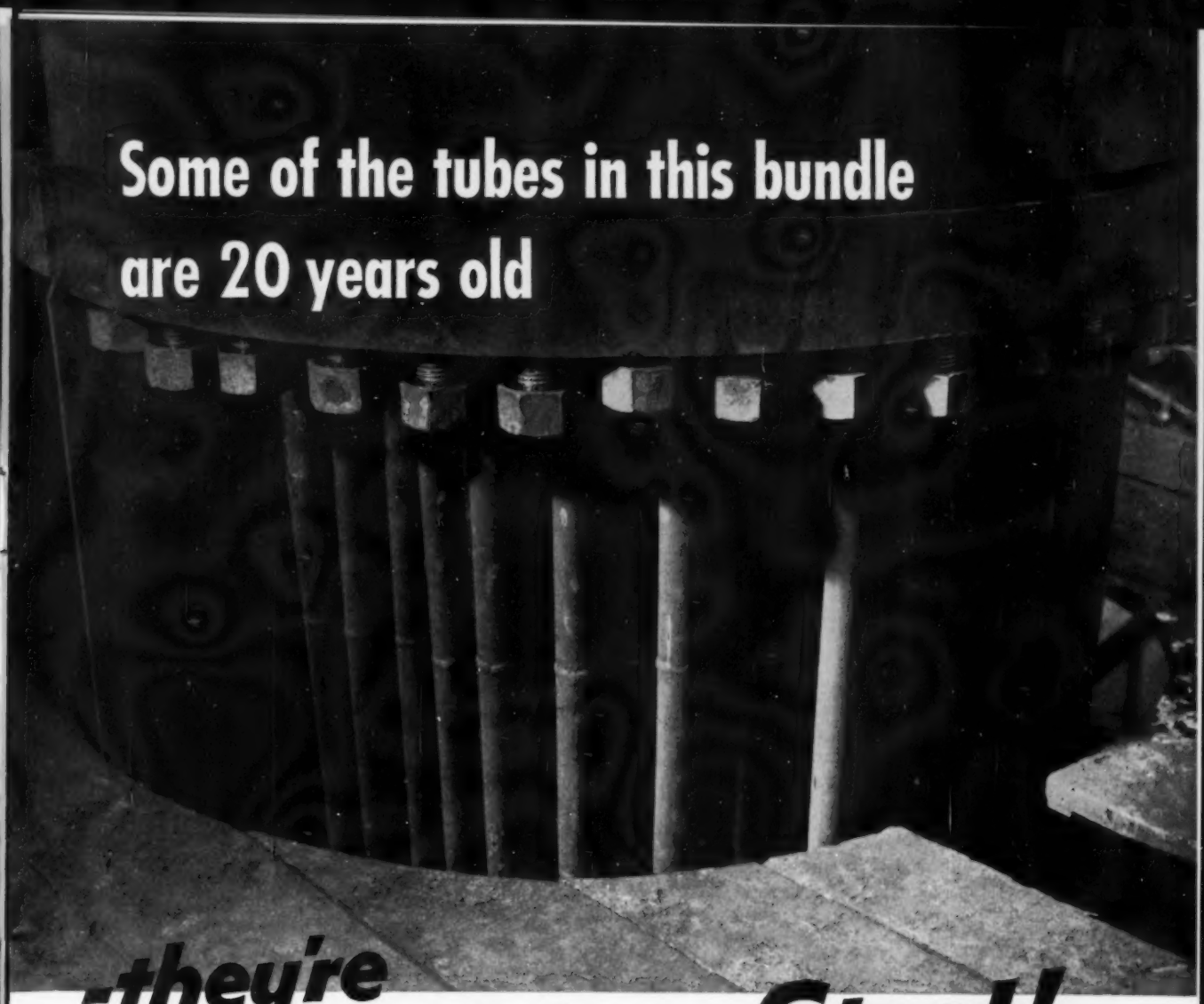
Some of the tubes in this bundle are 20 years old



...they're Stainless Steel!

This particular bundle of heat exchanger tubes is from a Thermal Cracking Unit at a major southwestern oil refinery. Some of these tubes have been handling a variety of corrosive products for more than 20 years. Yet, because they are Stainless Steel, they still get the inspector's "OK."

Stainless Steel's resistance to corrosive media frequently found in the oil made it a logical selection for this job. Its non-fouling tendencies have permitted longer runs, increased throughput, increased yields and decreased downtime.

The durability of these Stainless Steel tubes is proved by the fact that they have been removed, straightened and reinstalled. Some have been lengthened by heliarc welding on short lengths.

This is but one of many examples of the economy of using Stainless Steel in refinery operations. Its excellent corrosion and temperature characteristics, plus the freedom it gives from contamination, make it invaluable in keeping your refinery on stream.

Take advantage of the properties of Stainless Steel, and when you do, be sure it is perfected, service-tested USS Stainless Steel. For extensive data on the performance of Stainless Steels in refinery service, write for our 44-page book. Send your request to United States Steel Corporation, Room 4549, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

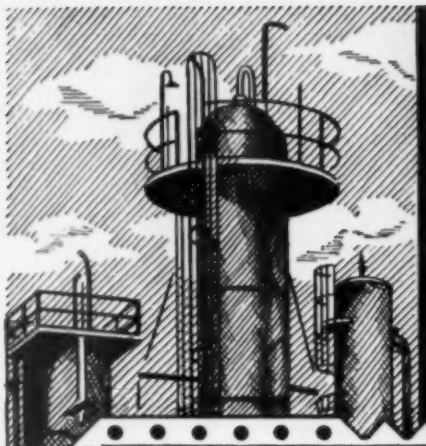
SHEETS · STRIP · PLATES
BARS · BILLETS

USS

PIPE · TUBES · WIRE
SPECIAL SECTIONS

4-1292

UNITED STATES STEEL



INCREASE throughput capacity
ELIMINATE costly liquid loss
IMPROVE overhead product quality
REDUCE harmful air pollution
with

YORKMESH DeMISTERS

CASE STUDY No. 1005

YORKMESH DEMISTER REDUCES MAINTENANCE ON PROPANE COMPRESSORS

OBJECTIVE:

To reduce high maintenance costs on propane compressors.

PROBLEM:

Liquid entrainment in the propane from the de-asphalting unit was the cause of continuous compressor difficulties.

SOLUTION:

A 4'-6" I.D. vertical knock-out drum fitted with a 6" thick Monel demister mounted on a standard York Monel grid was installed in the compressor suction drum.

RESULTS:

Checks made during a six month study showed:

(a) No scale on the compressor valves.

(b) Compressor valve maintenance was cut in half (remaining maintenance was not due to entrainment).

(c) Pressure drop through the Yorkmesh Demister was less than ½" of water.

(d) A centrifugal separator installed downstream from the Yorkmesh Demister at the same time the Yorkmesh Demister was installed had collected no entrained liquid.

Note: For the full story of how this 6" Monel demister reduced compressor maintenance write for case study #1005

YORK

OTTO H. YORK CO., INC.

6 CENTRAL AVE. • WEST ORANGE, N. J.

Now

SINGLE
SEAT VALVES
FOR
Large Flow Rates
WITH
ANNIN'S

BUNYAN SERIES

DOMOTOR VALVES

Body Sizes... 6"- 8"- 10"

Body Design... Globe, angle and 3-way. Tight shut-off, single-seat body. Standard, Cooling Fin or Doolseal bonnet.

Body Ratings... Standard ASA 300, 600, 900, 1500, and 2500 PSI.

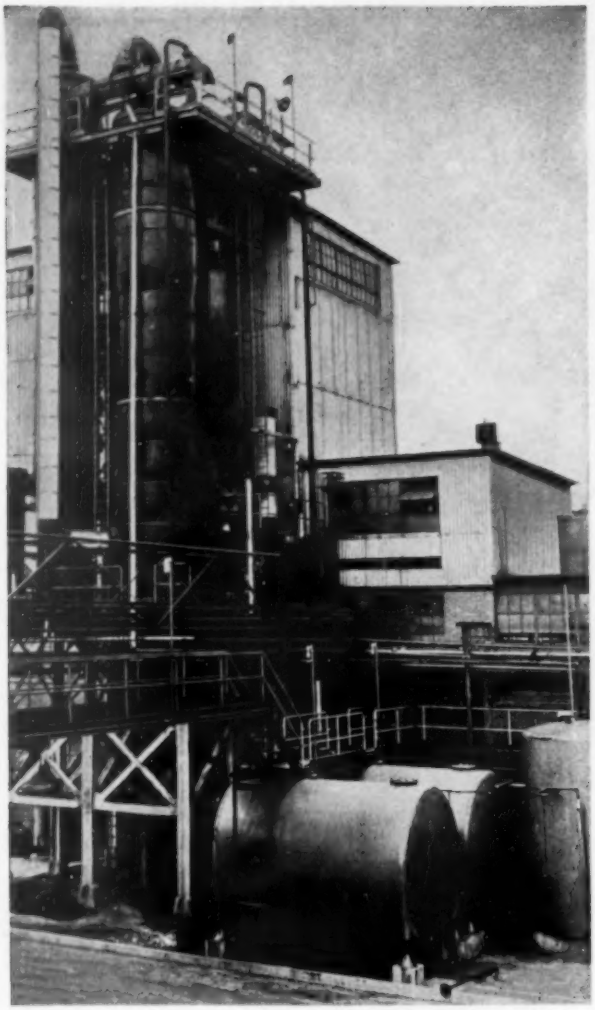
Operators... Domotor, cylinder and handwheel. Domotor operators for all pressures and pressure drops. Piston sizes of 200 and 400 sq. in. for thrusts up to 40,000 lbs. Domotor or Cylinder strokes to 6" as required.

You'll profit by learning more about the superior features and better performance of Annin Control Valves.

THE ANNIN COMPANY
Dept. PP, 6570 East Telegraph Road, Los Angeles 22, Calif.

ANNIN *Control* **VALVES**

 (To obtain more data on advertised products see page 1784)



Phenol Purification in a Michigan plant. In this type of equipment the effect of corrosion by phenol is amplified by high temperature. To prevent trouble from this source Nickel-Clad Steel is used in fractionating columns, condensers, piping and tanks.

What does Experience Prove...

about protecting Phenol Purity and Safeguarding Equipment?

In the manufacture of synthetic phenol, corrosion is a two-edged sword.

First of all, the acids and alkalies employed in syntheses are extremely corrosive to process equipment. Secondly, even small amounts of metallic corrosion products will seriously affect the color and purity of phenol or phenolic products.

At points where corrosion is mild, it may be practical to accept minor risk . . . but at critical stages, control is essential. Experience has proven that at the majority of danger points, Inco Nickel Alloys are among the most useful common engineering materials.

During the actual manufacture of phenol, for instance, Monel is employed in sulfonators to protect against corrosion by sulfuric and benzene sulfonic acids. In processes which rely on high temperatures or pressures at critical steps, Inconel is used to furnish the necessary corrosion resistance . . . plus high strength characteristics.

In handling phenol itself, product purity is the important factor. Pure nickel equipment is therefore a standard material for storage tanks and tank cars where contact may be for long periods. Nickel is equally important in such applications as stills and fractionating equipment where metallic pickup may be accelerated by high temperatures.

If you make, ship, store, or use phenol, chances are excellent that your corrosion problems will yield to Inco Nickel or one or another of the Inco Nickel Alloys.

Inco's experience with phenol equipment problems can help you find out quickly . . . and easily.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys

INCO TRADE MARK

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL • "S"® MONEL
INCONEL® • INCONEL "X"® • INCONEL "W"® • INCOLOY®
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2 REFINERY SAFEGUARDS

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DESALTING PROCESS

Specified by leading refiners because of its low initial cost, ease and rapidity of installation and low operating costs. Its low-residual-salt treating results are unsurpassed.

KONTOL

CORROSION PREVENTIVES

Kontol liquid organic corrosion preventives have proved effective and economical as refinery anti-corrosion measures. Very easy to apply, they effectively protect carbon steels, as well as alloys.

For complete information on these refinery safeguards, write or call

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A Division of Petrolite Corporation

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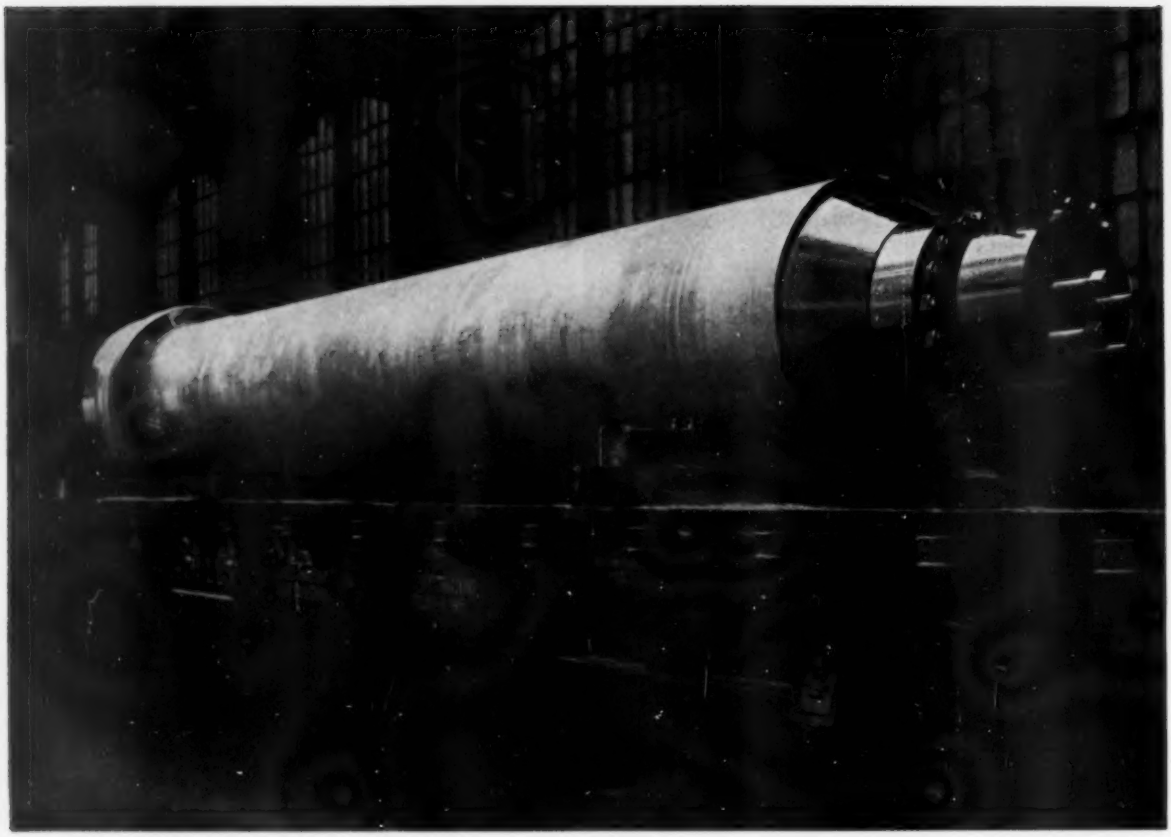
Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTING

TKR 54-14 WATER DE-OILING • SCALE PREVENTING • PARAFFIN REMOVING

 (To obtain more data on advertised products see page 1784)



Extra STRENGTH ... *Added* SAFETY ... *Sealed* for SERVICE

MIDVALE FORGED PRESSURE VESSELS

Product-Converter
Body Diameter-55"
Inside Diameter-40"
Ring Diameter-68¼"
Overall Length-37'—2-15/16"
Operating Pressure-5,625 P.S.I.
Tensile Strength-50,000 P.S.I.
Shipping Weight-144,240 lbs.

From the time this converter was on the drawing boards at Midvale until it was ready to roll on this flatcar strength and service was the keynote. Veteran steel makers melted the right alloy steel. Skilled hands forged toughness into it. Modern sonic, hydrostatic, strain gauge and X-Ray tests assured unfailing performance.

This converter is not unusual for Midvale—not the largest, not the smallest we make. A 268,000 pound octagonal ingot was forged and machined to an overall length of more than 37 feet with a body diameter of 55 inches. Hydrostatically tested at 8,450 psi. for working pressures of 5,625 psi. . . . yield strength of 50,000 pounds.

Midvale engineers, working with those of the chemical company, designed this converter to fit the specific needs of the plant. At one end of the vessel with full diameter opening the head is held on by a screwed yoke. Sealing is effected by a triangular-shaped copper gasket, sealing force attained by set screws. The other end of the vessel is closed down to about one-half the main diameter, bolted on and a self-sealing steel gasket of the "delta" type used.

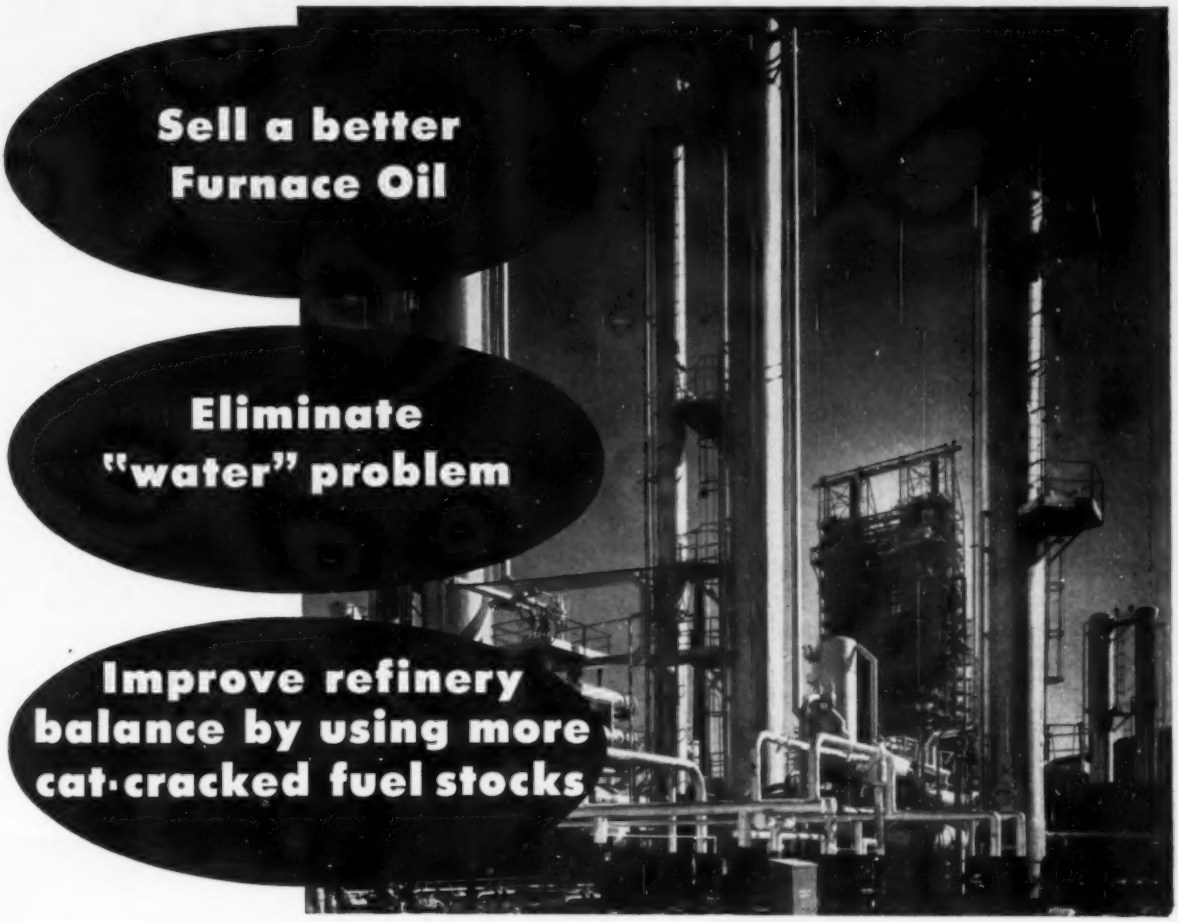
Converters, autoclaves, separators, high-pressure accumulators, reactors . . . Midvale can forge them for your plant to meet specific processing requirements of pressure and capacity. Let our engineers work with you from initial design to final installation.

THE MIDVALE COMPANY-Nicetown, Philadelphia 40, Pa.
Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

With NEW Dispersant FO



Dispersant FO is a new gum-dispersing, rust-inhibiting additive that greatly reduces, even eliminates, deposits and screen clogging in home heating units and storage tanks. Your product with FO will offer dealers many competitive advantages and greatly reduce their number of costly service calls due to clogged filter screens and nozzles.

"Wet fuel" is always *the big problem* for the distributor, dealer and home user. The active ingredient in FO is an entirely new chemical, developed especially for use in furnace oils. NEW DISPERSANT FO DOES NOT EMULSIFY WATER WITH BURNER OIL. It will settle the water out of burner oils in short order to provide a "dry" fuel.

Furnace oil with FO has exceptional rust-proofing properties. Steel and iron surfaces in contact with the oil and the water layer are made corrosion resistant.

This new additive improves stability and permits the blending of higher percentages of cat-cracked stocks without additional gum formation. It improves refinery balance, and you can cut costs by reducing the severity of acid treating of your cat-cracked heating stocks.

The stabilizing action and rust-inhibiting quality of Dispersant FO are obtained at very low dosages. Usually added in the ratio of 1 pint per 1000 gallons of oil stock, at any temperature, prior to shipment by tanker, pipe line or truck.

For complete product data and samples, write or phone the nearest Oronite office.

ORONITE CHEMICAL COMPANY

200 Bush St., San Francisco 20, Calif. • 714 W. Olympic Blvd., Los Angeles 15, Calif.
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ORONITE CHEMICAL COMPANY

2037

 (To obtain more data on advertised products see page 1784)

Here's How To Hold On

ROCKWELL-Nordstrom

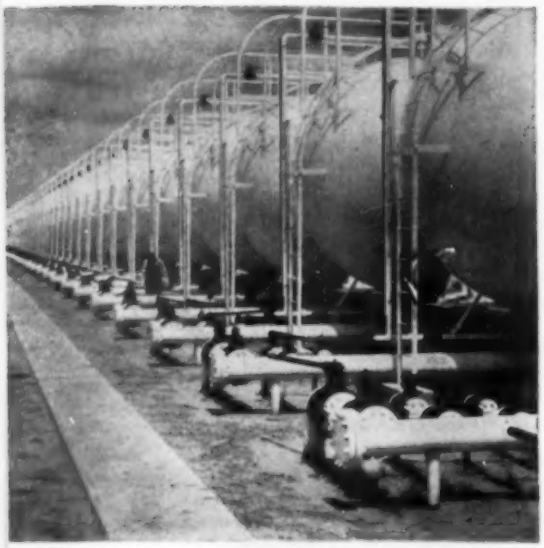
It takes a really efficient valve to hold light ends and petrochemicals. Rockwell-Nordstroms are the ideal valves for these services because they assure positive, dependable control with a minimum of maintenance.

A pressurized lubricant film between the valve plug and the body seals even the lightest hydrocarbons and eliminates uncertain metal-to-metal closure.

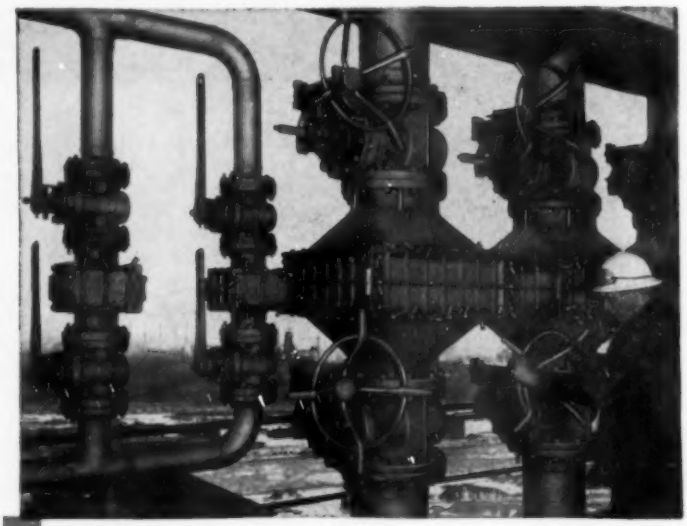
Pressurized lubrication also eliminates metal-to-metal friction on the working surfaces which means long-term economy in the maintenance of the hundreds of valves used in each refining and petrochemical operation. Less wear means less care and replacement . . . lower costs.

Rockwell-Nordstrom valves are manufactured in sizes through 30 in. Certain sizes are available in pressure ratings of 10,000 lb WOG.

Find out how Rockwell-Nordstrom valves



BUTANE STORAGE The Rockwell-Nordstrom valves on these butane storage tanks provide "no leak" service whether operated once a month or once every hour. Valve wrenches tell at a glance if the valve is open or closed.



FRACTIONATING These Rockwell-Nordstrom plug valves on a light ends fractionating unit can really be depended upon to do the job. Pressure lubrication keeps them ready for instant operation.

To Light Ends

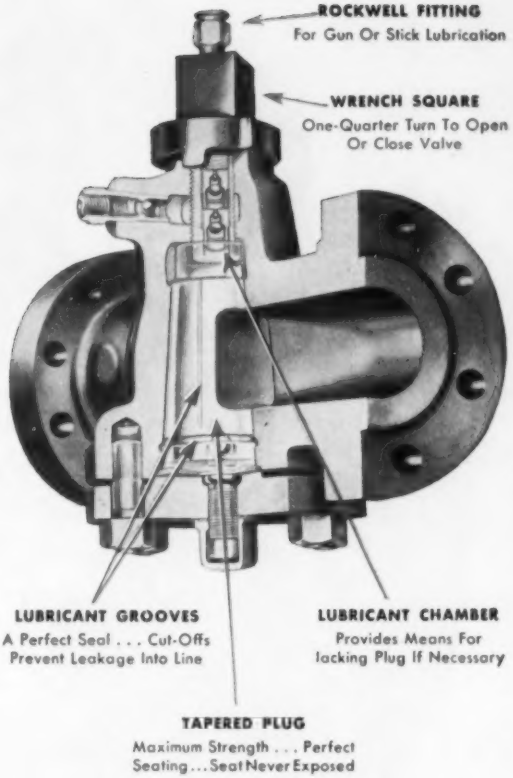
VALVES

can give you better service, greater efficiency, and lower operating cost than any other valve you've ever used. Write today to Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

ROCKWELL-Nordstrom **VALVES**

Lubricant-Sealed for Positive Shut-Off

ANOTHER PRODUCT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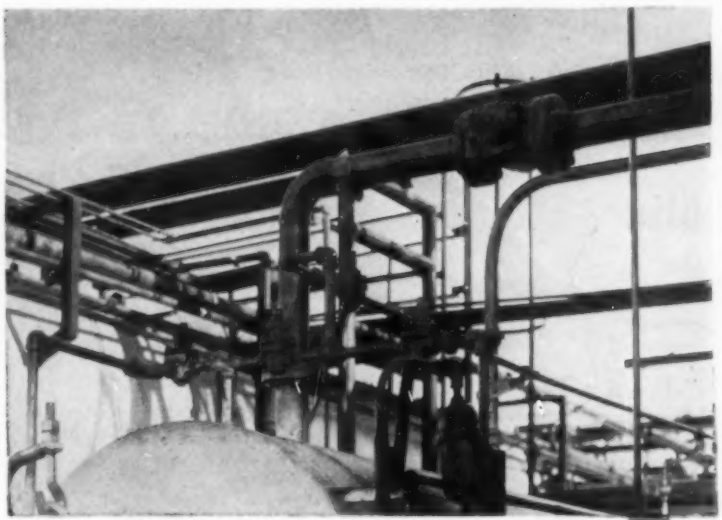
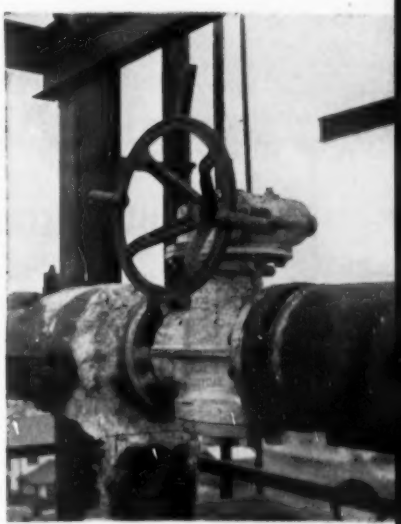


ALKYLATION UNIT

Rockwell-Nordstrom valves handle *both* the light ends and the sulphuric acid in an alkylation unit.



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Wherever flow requires dependable control, there's *the* place for Powell Valves. Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

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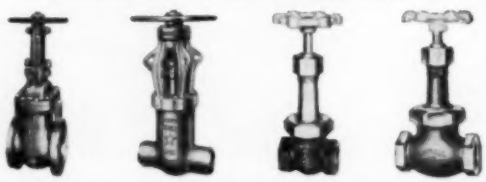

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BOMBS... OR FIRE... OR FLOOD... OR TORNADO ... you can handle them if you act now.

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Whatever the emergency is, everybody's going to want help at the same time. It may be hours before outside help reaches you. The best chance of survival for you and your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. Disaster may happen TOMORROW. Take these simple precautions TODAY:

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads and official CD films or literature that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.

 (To obtain more data on advertised products see page 1784)

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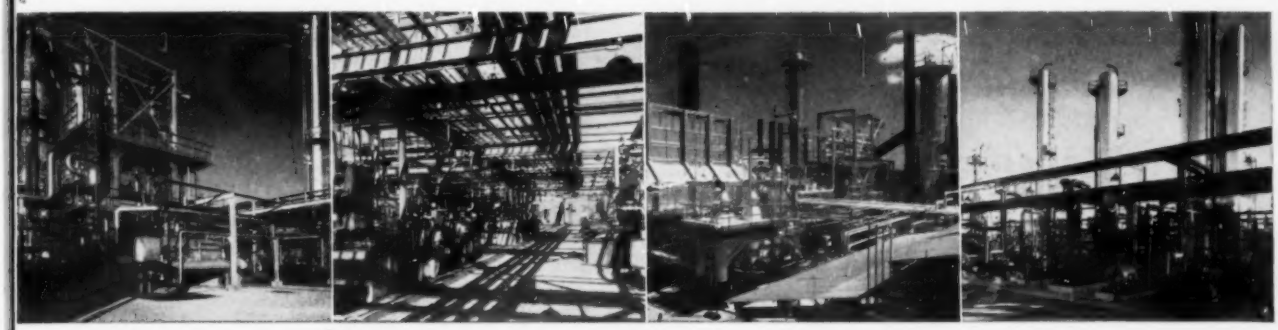

6 TANKS CLEANED IN 5 HOURS

Chemical cleaning by DOWELL prepared 216,000-gallon oil tanks for conversion to sulfuric acid storage

A steel company wanted to convert six 216,000-gallon tanks from fuel oil and gasoline storage to sulfuric acid storage. It was necessary to remove oil and tar film from the inside walls and ceilings of these tanks.

Dowell engineers, using special high-pressure hoses and nozzles, sprayed thickened chemical solvents over all internal surfaces from the tank floor. No scaffolding was required. The thickened solvents clung to the tank walls during the cleaning process. The entire surfaces of all six tanks—including seams, rivets and braces—were cleaned in only five hours.

Whatever *your* cleaning problem—pipe lines, boilers, process equipment, water wells—take it to Dowell. Their engineers have the experience, materials and equipment to help you cut cleaning costs—keep up production. Get in touch with the nearest of over 130 offices or write direct to DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. K-32.

Dowell engineers prepare solvents based on the type of deposit to be removed. They furnish all necessary pumping and control equipment. And they apply the chemicals according to the technique demanded by the job: filling, spraying, jetting, cascading or vaporizing. Dismantling is held to a minimum.

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Designed it and built it
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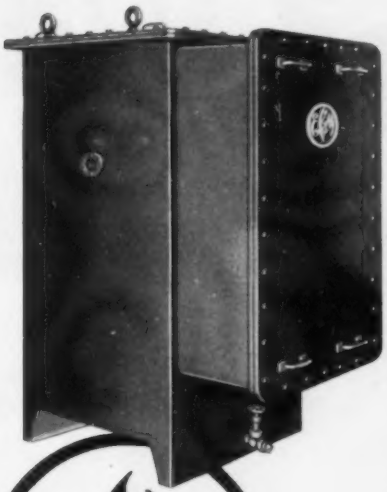
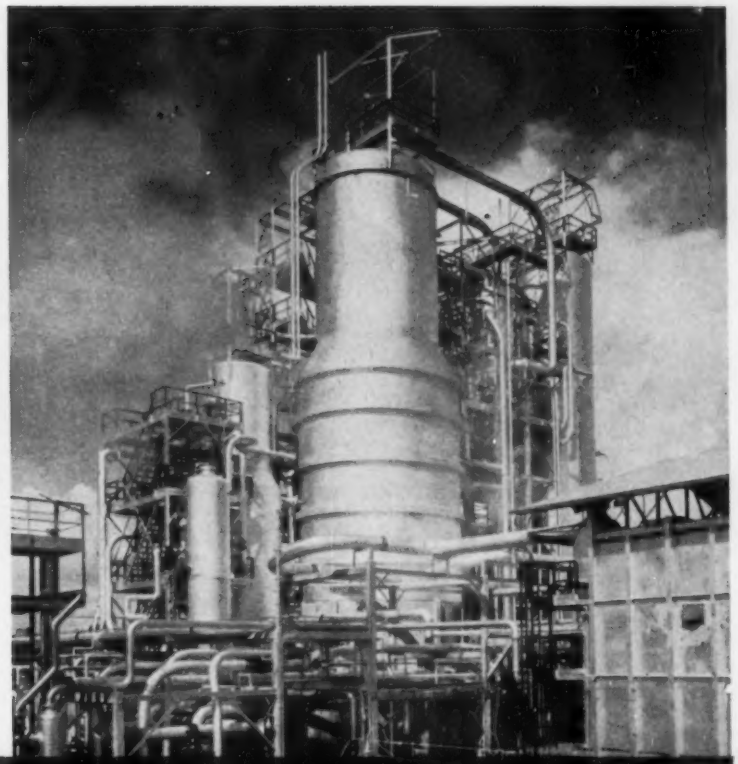
FOSTER WHEELER

165 BROADWAY, NEW YORK 6, N. Y.

EC&M Bulletin 1062 Type ZHS 2300-volt Motor Starter in Type VIII enclosure for Class I, Group D hazardous atmospheric locations.





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2200 TO 5000 VOLTS

HELP BOOST PETROLEUM PRODUCTION

● For maximum protection in hazardous locations, all connections, terminals and arcing parts of these Type ZHS Motor Starters are oil-immersed. In addition, oil-immersion keeps the mechanism thoroughly lubricated and protected against corrosion . . . eliminates the need for frequent inspection or maintenance.

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EC&M Type ZHS Starters for 2200 to 5000-volt motors are built in 50,000 KVA interrupting capacity and in the VALIMITOR (volt-ampere-limitor) style for use on power systems having infinite KVA.

Throughout the petroleum industry, EC&M Motor Starters are providing continuous safe service . . . helping to boost petroleum production.

Write for Booklet 1062 describing EC&M 2200-5000-volt motor starters

1054

THE ELECTRIC CONTROLLER & MFG. CO.

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Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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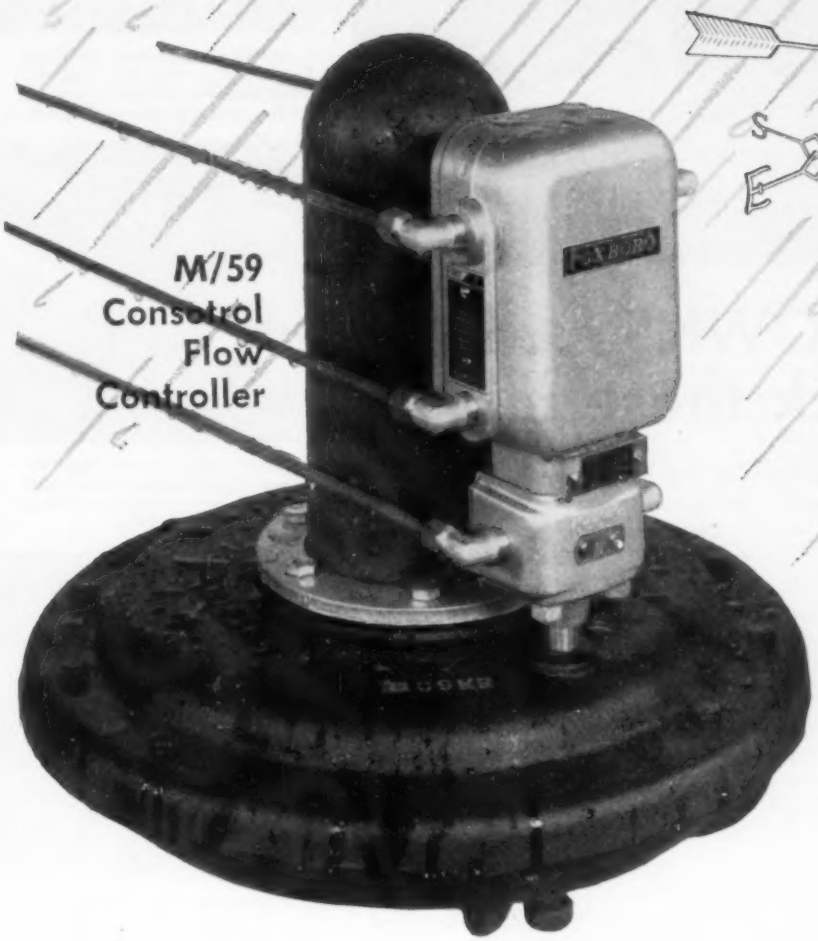
This Controller

requires no more attention than a weathervane!



Like a weathervane, the Foxboro M/59 Consotrol Controller can be installed completely exposed to the elements . . . and forgotten about! Unsurpassed in performance by any other flow controller, the M/59 is *completely indifferent to weather conditions.*

This rugged Flow Controller mounts directly on the air connection of the valve . . . at a fraction of usual installation cost. Its case is tightly gasketed, continuously purged, completely weatherproof, highly resistant to dust, fumes, and vibration. There's nothing to align, nothing to wear out. A flexure-strip fulcrum eliminates the friction and wear of conventional pivots . . . eliminates "conventional" maintenance.

In operation, the M/59 fully utilizes the speed and sensitivity of the Foxboro d/p Cell Flow Transmitter . . . does away with transmission lag . . . gives fastest recovery from process upsets. For the *complete* story, write today for Bulletin 470.

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Unique Simplicity — exclusive design permits fixed, optimum proportioning and reset values for liquid flows. Adjustable reset optional for gas or steam flow.

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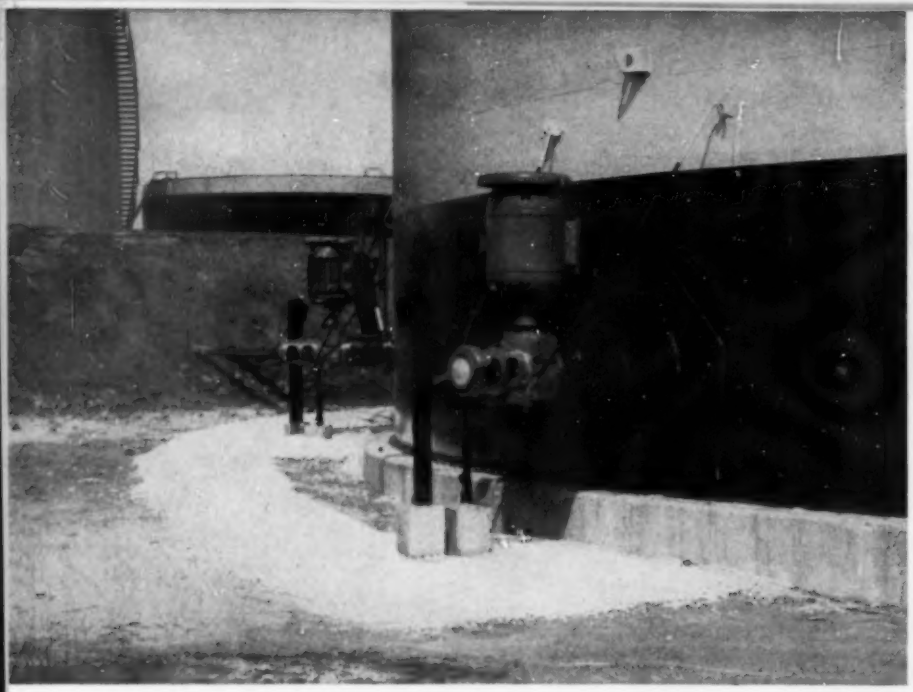
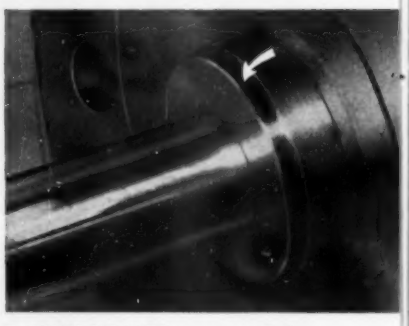
FLUID FLOW CONTROLLERS

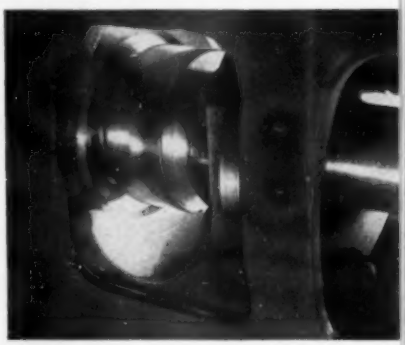
FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND



1. FASTER MAINTENANCE. To repack (or change a mechanical seal), this shutoff assembly is turned like a valve, quickly sealing tank contents from mixer.



2. SHAFT RETRACTS, squeezing a Teflon gasket inside the tank between seal collar and mixer end cap, positively preventing loss of product.



3. MECHANICAL SEAL (optional) can be removed from shaft as a unit, for quick easy replacement. You can change seals without draining the tank and without dismantling the mixer.

NO SHUTDOWNS . . . *EVER* . . . to repack these mixers

Any fluid mixer on a big tank sooner or later requires some maintenance. A stuffing box needs repacking. A mechanical seal has to be replaced.

You can't always wait for the tank to be empty. You don't want to waste time draining the tank.

And you don't have to do either.

You can repack the stuffing box (or replace the mechanical shaft seal) on a LIGHTNIN Side Entering Mixer, without ever draining the tank. You can do it in a few minutes—under a full head of 5 million gallons—without losing a pint of product.

EASY AS CLOSING A VALVE A few turns of the easy-to-get-at shutoff assembly prepare the mixer for repacking (or seal change). Every part is easily accessible.

You're always protected against mechanical seal failure. The LIGHTNIN shaft seal (optional now on side entering mixers) is a complete "package" unit—quickly replaceable at any time, without removing the mixer from the tank.

This is just *one* good reason why it pays to specify LIGHTNINS for blending, treating, TEL addition, bottom sediment control in crude storage tanks, and other big mixing operations.

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- ☐ B-103 Top Entering Mixers (propeller type)
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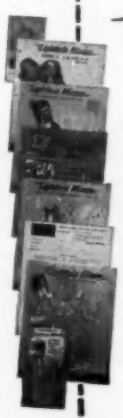

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PETROLEUM PROCESSING
NOVEMBER 1954

For 1955 It's An

All-Out Drive by OWIU on Oil

An organizing campaign aimed at the "biggest union the world has ever seen"

Final target is 1,000,000 members, big enough to "take on" the biggest oil or chemical companies

With probable heavy financial and staff support from the CIO itself

A Staff Report by the Editors of PETROLEUM PROCESSING

THE petroleum industry can look for the biggest, best-financed drive ever made in union organizing activity during the coming year. The drive will be headed up by O. A. Knight's Oil Workers International Union (CIO), and there is a strong possibility that it may be backed up by the CIO itself and funds exceeding $1,000,000.

Target of this organizing drive is a union in the oil industry the size and strength of the Steelworkers, the United Mine Workers, and other large nationwide unions. This would eventually be an organization of 1,000,000 or more members, with the capacity to "take on" the biggest of the petroleum and chemical companies whose employes up to now have remained outside big national unions.

Reason for the drive is two-fold: 1) the failure of OWIU to get the independent oil industry unions to go along with a merger proposal, and 2) a slow-up in reaching final approval stage of a merger between OWIU and the United Gas, Coke & Chemical Workers Union (CIO).

The outlook had been bright for an early merger of OWIU and the independents last February when 31 unions (including OWIU) sent their representatives to a convention in Philadelphia to consider the merger. The stage had been set for early ratification action on a constitution by the individual unions and for a merger convention this fall.

But, the individual unions didn't jump on this bandwagon. Only three of them have approved the proposal, and three others have turned it down. The remaining 24 who showed interest originally have said and done nothing. Apparently they are waiting to see how the land lies.

One of the biggest stumbling blocks has been the failure of the Central States Petroleum Union—largest of the independents and having about 30,000 members—to go along with the merger. Without this leadership, the drive can fizzle or drag along for a long time.

While this program was grinding to a virtual standstill, OWIU did succeed in getting the United Gas, Coke & Chemical Workers Union to agree that it would join its 84,000 members with OWIU's own 90,000 to form a new Oil & Chemical Workers International Union.

Three steps are involved in finalizing the formation of the new Oil & Chemical Workers International Union. The first, approval by OGCWU, was completed in September. The second is approval by Knight's own OWIU, and the third is the approval at a joint convention of both unions.

Yet, even here, delaying actions have slowed up the original timetable, which called for the second and third steps to be completed simultaneously this November. First, the executive board of the chemical union decided against trying to hold a special convention at the same time OWIU was to meet in Cleveland, postponing such a meeting to early in 1955. Then, the OWIU executive council postponed its own annual convention in Cleveland to next March, "or adjacent month" when the chemical workers could meet jointly to complete the proposed merger.

Open door on the organizing drive has resulted, it was apparent, from the failure of an early merger of OWIU and oil industry independents. What has happened is this: although the OWIU has not withdrawn entirely from its plan to merge with the independents, it has definitely been released from a two-year old committment that it would not try to organize these unions, Knight has stated.

The background is this: In 1952, the independents and the OWIU formed a coalition aimed at gaining a wage increase, OWIU promised at that time it would not try to organize any independent union within the coalition. This pledge was still in effect during the later efforts to bring about an actual merger of all oil unions—rather than a simple coalition. Withdrawal of the pledge means that Knight's union can start a heavy campaign on petroleum plants with independent unions and start taking members away.

A promise of money and men for the organizing

drive, as well as further help from individual CIO unions was made by CIO President Walter Reuther at a convention of the chemical union in St. Louis in September.

"You aren't big enough to do it alone," Reuther said. "All you can do is organize the fringe companies. With CIO help, you can move in on those that really count."

On the other hand, Reuther also told the convention flatly that if the merger was not approved, CIO would cut off financial and staff assistance.

A certain amount of reluctance to take action shown by the chemical workers, even after Reuther's two-edged sword thrust, has continued in evidence since the September meeting. This is demonstrated by the recent postponement of the joint meeting for approval.

Merger proponents, including the chemical union's President Elwood Swisher and CIO President Reuther, had urged strongly that the merger convention be held in January.

Merger opponents, however, had protested that the merger was being rushed or railroaded through, and that the chemical union locals were unable to finance two conventions so close together (chemical union's convention was held only recently). Any delaying action will be of help to merger opponents in developing more sentiment against the merger.

The organizing drive, which OWIU says will involve sending out "hundreds of professional organizers" in a mass attack on major oil and chemical companies next spring, will have to overcome the same objections as those voiced by anti-merger forces among the independents. The aim, of course, is at the "grass-roots" level, winning individual members away from the independent unions and into the OWIU fold.

OWIU had already drafted—last June—a 16-point program of benefits which would result from a merger. OWIU can argue that the same benefits accrue to the oil workers, whether he gets "on the team" via merger approval or via the all-out organizing drive.

Anti-merger forces argue that if an independent union joins the proposed big union, it would lose its identity. They say it would have little voice in the new union's policies and practices. And that if company-wide bargaining resulted, individual locals would be still another step removed from decisions as to their wages and working conditions. They would be ruled from afar, this argument goes, and their fate would be in the hands of strangers.

Knight insists that the opposite would be true: that the new, larger union would be a megaphone to amplify the worker's voice so it would reach the distant ears of the company executives.

Concrete action against the merger has already resulted at one refinery. A powerful local unit of Central States Petroleum Union at the Standard Oil Co. (Indiana) refinery at Whiting, Ind., has split off from CSPU and organized into a new Independent Petroleum Workers of America. It is headed by J. J. McKenna, a vociferous merger opponent who has been protesting OWIU efforts to "take over" the independents. The new IPWA aims at no merger with OWIU but rather seeks to rival it. McKenna is said to be campaigning actively among independent union leaders asking them to unite in the new federation.

Speculation is that McKenna feels an opportunity now exists because of the fear of OWIU by some of

Sinclair Case Spells Out OWIU Demand Pattern

THE wage demands OWIU has made against Sinclair Oil Co. have been rejected by the company, and further talks have been recessed for the time being. However, the 23-page brief drawn up by the union to support its arguments covers points OWIU has used and is using in other negotiations.

It gives clear-cut evidence of the kind of demands that can be expected from OWIU or any larger union:

"Wage increases for oil workers are justified on the basis of any, and all appropriate criteria, the various criteria demonstrating the necessity for increases ranging from 14¢ to $2.80 per hour."

The brief made the claim that not only have "the historical and current conditions of the Sinclair Oil Corporation and the oil industry as a whole justified significant adjustments in wages for oil workers," but that "the welfare and continuing prosperity of our society require substantial wage increases throughout the economy."

The OWIU brief then said that the "only legitimate issue remaining is the question of the amount of the increases appropriate under the various criteria. In this connection the following conclusions seem to be in order:

"1. Based on the average increases in profits for the (Sinclair Oil) Corp. and the industry in recent years, it appears that wage increases averaging at least 29¢ per hour would be necessary if the workers are to share in the prosperity of the company and the industry.

"2. An average increase of 36¢ per hour would be required to bring the oil workers in line with productivity in view of the average increase of at least 7% per year since 1949.

"3. Even on the basis of increasing productivity for the whole economy—ignoring all other factors—oil workers would require average wage increases of 16¢ per hour to make up for the lag during the past few years.

"4. In order for Sinclair employes to realize the same percentage increase in wages as Sinclair stockholders have enjoyed from their investments since 1949, namely, a 180% gain, wage increases of $2.80 per hour would be required, which would raise average hourly earnings to $5.07.

"5. To partially eliminate inter-industry inequities between the more highly skilled classifications in the oil industry and the higher-paid classifications in other major industries, an increase of 50¢ per hour would be necessary for the (oil) workers in those classifications.

"6. Increases averaging 14¢ per hour for all oil workers would be required to bring their increases up sufficiently to equal increases gained by workers in other basic industries during the past four years. This, of course, would only maintain the previously existing relationship and would not relieve the inequities.

"7. For a full-employment economy, average wages for all workers must be increased by as much as 10 to 15%. In order for the oil workers to participate in this necessary increase in purchasing power, average earnings would have to be improved by 27 to 35¢ per hour."

the independent union people. Also, the fact that the proposed merger has bogged down so thoroughly has given him an opportunity to try his own hand at such an organization.

McKenna's organization, which split off from CSPU, had previously voted against the proposed merger while it still was CSPU local No. 100. However, the split did not occur because of this fact. The local had been involved in a hassle with CSPU over non-payment of per capita dues and was facing dismissal on that score from the parent union.

Other independents that have voted against the merger were: Casper, Wyo., Local No. 124, CSPU, and the Independent Oil Workers Union of Oklahoma, Ponca City. The votes in favor have been: CSPU Local No. 101 at Sugar Creek, Mo.; CSPU Local No. 109 at South Bend, Ind.; and Bayonne Texaco Employes Ass'n. at Bayonne, N. J.

Competition outside the CIO also faces OWIU's attempts to establish one big oil union. The American Federation of Labor will attempt to organize refineries in the Pacific Northwest under a single contract, such as exists in the Pacific Coast shipyards, rather than negotiate individual contracts between management and 14 different crafts involved.

This was a statement made by James Brownlow, president of the AFL Metal Trades Department, after a meeting in Bellingham, Wash., in October, to plan organization of workers in Ferndale refinery of General Petroleum Corp. and Anacortes refinery (still under construction) of Shell Oil Co.

Wage hike demands are seen as a likely part of over-all union problem along with organizing drives which face the oil industry in the near future. There is little or no doubt that OWIU has been setting the stage for a withdrawal of the "no-strike" pledge it made in June when it announced it would go after a 5% wage raise.

The union said it was taking this approach because the oil companies had complained that union representatives came to bargaining tables with "loaded pistols"—that is, the threat to strike unless they were given what they wanted. So, OWIU said, it was "unloading" the pistol.

However, a recent issue of the OWIU newspaper indicated that the "unloaded pistol" approach had apparently failed and the union is ready to start using ammunition. The newspaper article quoted Knight as saying:

"We are becoming more and more convinced that reasonable, logical discussion of facts will not convince management of justification of wage increases. We would have felt somewhat better about our experiment if some of the major companies had actually engaged in full-scale and detailed discussions of the wage question with us, even if those discussions had not resulted in increases."

Knight said the "no-strike" pledge was still in effect, but he made it clear that it won't be long. A 27-man policy committee, which has authority to revoke the pledge, will "review" the policy in November, even though the OWIU convention itself has been postponed to next spring.

Principal argument OWIU is using for more wages this year is that the oil companies can afford it. This was made clear in a brief it drew up to support its arguments with Sinclair Oil Co., the only firm with which it has a nationwide contract. The brief spells out a pattern OWIU is using in other negotiations. (See "Sinclair Case . . ." p. 1726.)

Why We Report on Knight's Activities . . .

TWO readers have recently asked why PETROLEUM PROCESSING carries articles reporting the activities of Jack Knight and his OWIU.*

One reader based his question on the theory that such stories merely serve as a sounding board for Knight, and that our play of the subject "has been a bit distorted and out of proportion to its significance in a so-called trade journal or technical magazine." The other suggested that we "keep these d - - n Communists out of your magazine or else keep your magazine!"

Both reactions disturb us—the first because it indicates a lack of appreciation of the important part the technical man plays in management-labor relations; the second because it indicates an emotional approach to a serious problem.

Our position is this: Many readers have responsible management positions—as executives, managers, superintendents, supervisors and foremen. In these positions they have a very real interest in the labor situation; the supervisors and foremen in particular are in many cases the direct contact between top management and the workers.

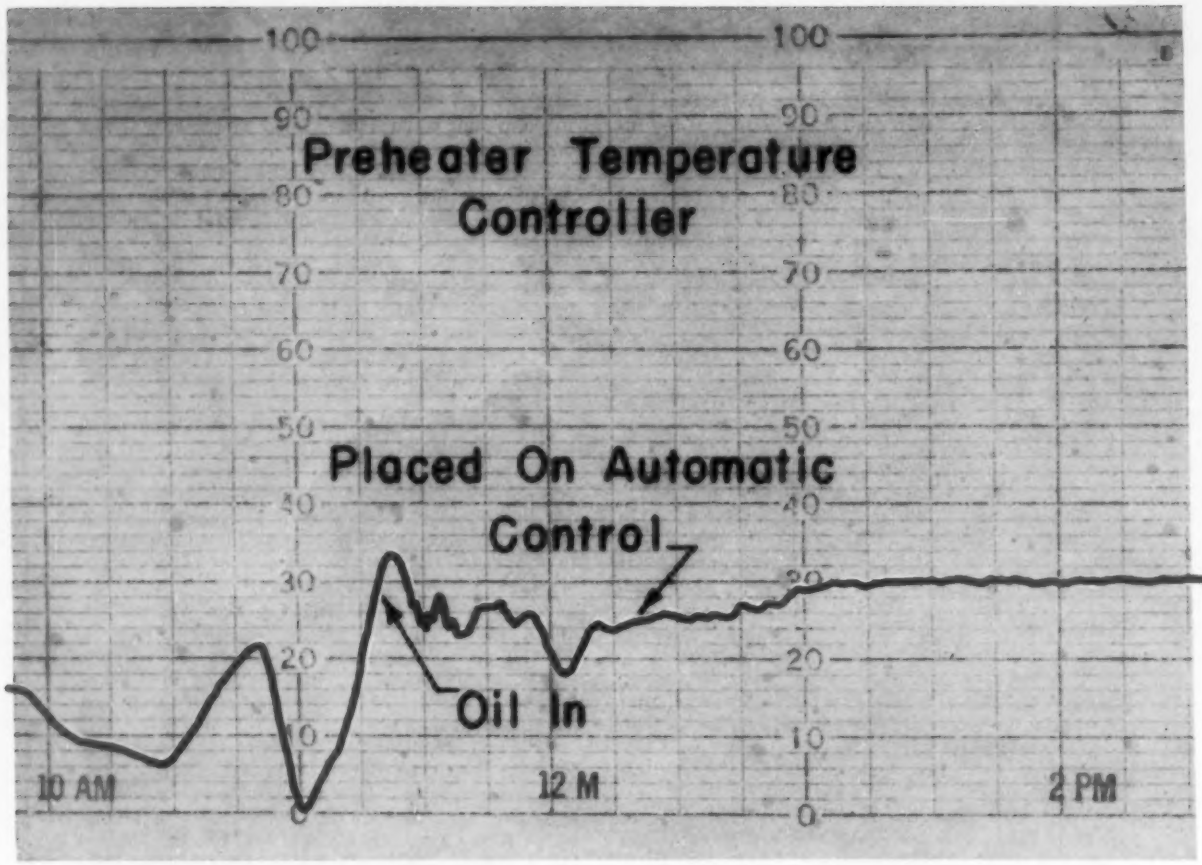
We believe that the more management men (including foremen) know about Knight, his strategy and his plans; the better equipped they will be to deal with the situation—the better able they will be to answer questions raised by workers.

We believe it is our responsibility—even as a technical magazine—to give our readers the information they need to do a more effective, intelligent job. If that job involves dealing with labor, then we should give them information on labor. For that reason we have reported and will continue to report the facts as we are able to assemble them. We do not feel that such articles published in PETROLEUM PROCESSING lend prestige to or advance Knight's cause. On the contrary they help show it up in its true light.

You may say it is top management's responsibility to pass such information down the line. It is—and we are not attempting to usurp management's job. We are augmenting it with reliable information from outside the internal lines of communication.

With respect to the "d - - m Communists," we don't believe Knight is a Red. He might perhaps better be termed a Socialist—or even a sort of "Capitalist," greedy and grasping for the power that his dream-union could give him. But to damn him as a Communist avoids the issue—and represents an angry, emotional view of the problem. Maybe you should get angry at him. But do it with a cold, calculating kind of anger—not a red-hot, blinding rage, lacking in clear thinking. —*W. F. B.*

* "And Now a Big Union in Oil," March 1954, p. 349; "Push Is on for Big Oil Union," July 1954, p. 1037.



LESS THAN TWO HOURS from start-up to full control, one of the reasons . . .

Why Rock Island Went Electronic

OPERATING experience with one of the country's first complete process units to be electronically controlled has convinced the users that electronic instrumentation for petroleum processing is here to stay. The unit is the new 2400 b/d UOP-designed Platformer at the Indianapolis, Ind., refinery of Rock Island Refining Corp.

The entire unit was "on control," or "in line," less than two hours after start-up, as shown in the illustration above. As indicated on the temperature recorder chart, feed stock began flowing at 11:20 a.m., the unit went into automatic control at 12:20 a.m., and was in line shortly after 1:00 p.m. It is this kind of a record that supports Rock Island's flat statement that any future instrument installations in their plant will use nothing but electronic control.[1]

Five advantages are seen for electronic controllers, in comparison with the more widely used conventional pneumatic control. These are in addition to one already well-known—and perhaps somewhat over-rated — feature, that of high speed transmission of signals over long distances. These advantages, as outlined by D. M. Boyd, Jr., chief of instrument dept., Universal Oil Products Co.,[2] include:

1—Increased reliability in cold climates.

2—Elimination of the need for tubing racks.

3—Increased flexibility in some of the more complicated control problems.

4—Better and closer control.

5—Less "noise," that is, less tendency to be sensitive to possible outside interferences.

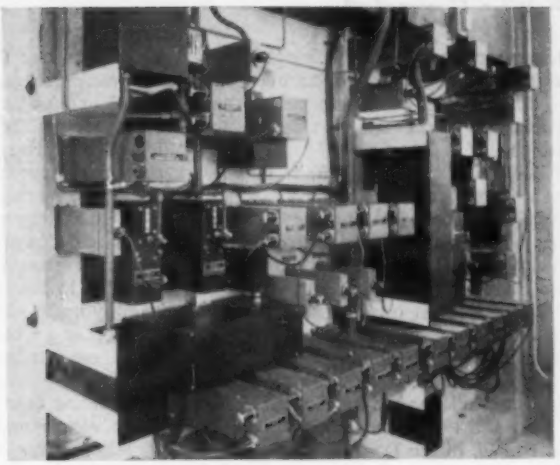
Climate, particularly low temperatures, was pointed out as a serious handicap to air operation because of the ever present possibility of a freeze-up due to moisture in the instrument air lines.

No tubing racks are needed when operation of the instruments is by electricity. All transmission of measurement and control functions between process and control room is electrical. The usual air lines can be replaced by conduit which can be laid in an existing rack supporting process piping. Or, the electrical transmission lines may use the conduit already installed in the plant for illumination circuits and thermocouple lead lines.

A major part of the installation cost of an instrument is in building the support rack for air tubing. The tubing has to be watched continuously for possible leaks due to mechanical vibrations and temperature changes.

Increased flexibility for some of the more complicated control problems can result with electronic control installations. Much thought is being given today to the possibility of using a computer to operate the processing plant. More progress has been made in this direction than is generally realized, Boyd points out:

CONSPICUOUS FEATURE of Rock Island's control house is virtual absence of instrument tubing. All electrical circuits are housed in a few conduits



SIMPLE MAINTENANCE results at rear of instrument control panel when electronics are used, because of the absence of multitude of tubes

"Where is the dividing line between a computer and normal process control techniques? We are cascading, limiting, and overriding controllers today that are capable of multiplying, integrating, or differentiating. The combustion control people have made use of electrical signals for interrelating the actions of several controllers. It is certainly probable that more of this will be done in the process control industry."

Better and closer control does not necessarily mean faster control. The UOP engineers conducted frequency response tests to compare electronic with pneumatic controls. They tried them out with electronic controllers versus valve-mounted pneumatics and with the pneumatics separated from the valve by 100 ft. of tubing and 6 ft. of tubing. They also tried them with the 100-ft. length of tubing plus a pneumatic amplifier at the valve.

Performance, surprisingly enough, showed that the new electronic controllers are not quite as fast as properly installed pneumatic controllers, although they are faster than the usual installation of pneumatic controllers.

If speed were the only consideration, then the industry would not have to be ready to change to electronics. However, most of the critical control points on a processing unit have long time constants due to lag in the process itself, and a fast action on the controller will not help the over-all control materially. Under these conditions, however, the dead band, or area of lack of sensitivity, in the controller does become important. The greater this dead band—the less the sensitivity; that is—the longer will be the time required for the controller to detect the initial error between the measured variable and the desired value.

In other words: assume the dead band is relatively wide. It is possible that a process temperature may change slowly and not be detected until it is fairly large. Then, the instrument suddenly will "catch up," acting as if it had sensed a sudden change and the correction made on a valve will be large, possibly causing a plant upset.

The normal design of a temperature controller of the thermocouple type has not permitted optimum use of the derivative function, because there usually is a mechanical means of balancing the potentiometric circuit in order to convert the electrical impulse (from the couple) to a pneumatic control impulse and to provide a record. It is this mechanical balancing system that may not have the desirable sensitivity.

Is This The Future?

There's a story going the rounds in instrument engineering circles about the time a refinery instrument man called his local supply house and said:

"Is Jones there?"

"No, Sir," was the reply.

"Is Brown there?" he asked.

"No, Sir," the reply.

"Well, is Smith there?"

"No, Sir."

"Well, just who is in the office today?" he finally demanded.

"Ain't nobody here but us automatic devices, sir."

With the electronic control system, it is not necessary to interpose the mechanical balancing step to convert the electrical thermocouple signal to a control function.

The Rock Island installation has demonstrated the value of this feature. Derivative settings have been adjusted to rates that were never thought practical before on similar applications because of the distorted picture that was obtained of the rate of change in the process. By being able to use greater derivative action and by having greater sensitivity in the controller, it has been possible to correct even very small temperature changes before they were noticeable on the recorder.

Electronic controls appear to have less "noise." This problem has not had a great deal of study. However, frequency response analyses of most of the critical process control problems show that the controlling lag exists within the process itself. The derivative function in the controller has been shown to be useful in moving this lag towards a shorter period to give an improvement in over-all control.

However, this requires some rather long time constant settings on the derivative unit. It is often found that full use can not be made of the derivative function because of the noise present in the system, either in the process or in the controller.

With the electronic controller, it should be easier to make use of some of the servomechanism techniques of filtering out the undesirable noise that is upsetting to the controller, and thus obtain more effective use of the derivative function.

Actually, only the first two advan-

tages mentioned—cold climate operability and elimination of tubing racks—were the initial selling points that persuaded Rock Island to go electronic.

Simplified servicing and maintenance is a further advantage that has become evident with increased use of the equipment. Control board equipment was designed at Rock Island with this in mind. Each of the units can be plugged into its own housing. If one of the units need servicing, the repair man has only to unplug the unit and plug in a spare. All of the recorders and controllers are interchangeable.

A small amount of air is still used, of course, in the Rock Island installation. Valve actuation is still by air through diaphragm motor control valves, and one non-critical process variable—liquid level—is measured by means of pneumatic instrumentation.

The possible problem of climactic conditions affecting operability of the electric-pneumatic relays on the air-actuated valves has been overcome by mounting a small electric heater on the pilot valve block to lessen the possibility of ice formation at this point.

Air is a poor medium for valve operation. actually, according to Mr. Boyd. For one thing, it is expensive. An instrument air system for a plant with 80 controllers, for example, could easily cost $15,000. The compressibility of air presents serious problems sometimes when there is a dynamic unbalance across the control valve.

Air diaphragm motors have always presented a problem to designers of diaphragm control valve, he pointed out, due to their short stroke and instability under severe valve unbalance.

Another problem inherent with an air system has been the positioning of the valve in case of an air failure. Most of the time it would be best for the valve to remain in one position on air failure. This is very difficult to accomplish with a diaphragm valve.

An interesting solution to the problem of air actuation was suggested by Mr. Boyd. This is the electro-hydraulic approach, utilizing a mechanism not unlike that used in automobile power steering. A relatively small electric motor and a pump equipped with an accumulator can deliver a large amount of power for a short time, probably enough to handle most of the normal transients.

The output of the controller would be used to operate the pilot valve in the hydraulic line. While such a system is capable of extremely high speed performance, it is doubtful if it would be necessary to consider any response faster than 1 cps (cycle per second) for a majority of process uses. For this reason, a much simpler and consequently less expensive system could be used.

If an instrument air system could be eliminated completely from a processing plant, it would be possible to spend approximately $175 extra per control valve over the present cost of a pneumatic valve for investment in such an electro-hydraulic mechanism.

The installation at Rock Island's refinery consists of electronic control units made by Swartwout Co. and installed in a control panel arrangement developed and built by Panellit Co.

(1) "Rock Island's Electronic Controlled Platforming Unit," C. O. Anderson, Rock Island Refining Corp., Indianapolis, Ind., presented at Casper, Wyo., regional meeting, Western Petroleum Refiners Ass'n., Sept. 24, 1954.

(2) "Why Electronic Process Control?" David M. Boyd, Jr., Universal Oil Products Co., Des Plaines, Ill., presented at International Instrument Conference of Instrument Society of America, Philadelpha, Penna., Sept. 13-23, 1954.

Electronics Keynote to New Trends

THE new electronically controlled process units now gaining a high degree of interest in the refining industry are regarded by many control engineers as just the beginning of a period of considerable growth in this field.

In addition to the unit at Rock Island, described in the accompanying article, an 8000 b/d catalytic reforming unit built by Atlantic Refining Co. at its Atreco, Texas, refinery, also has been set up for complete electronic control. (An article describing this unit has been scheduled for an early issue of this magazine. Watch for it.)

These practical applications of progressive concepts in control engineering represent only a portion of a number of new developments which have significance to the petroleum processing industries. Among the new ideas, many of which were revealed for the first time at the International Instrument Exposition of the Instrument Society of America in Philadelphia in Sept., one of the most significant was—data reduction or automatic logging.

Data reduction's chief aim is to provide the petroleum, petrochemical, and chemical processing industries with a tool that can absorb and correlate the tremendous amount of complex process information necessary in routine, daily operations of the plant.

Two companies active in the manufacturing of such equipment—Fischer & Porter Co. and Beckman Instruments, Inc.—now offer data loggers as standard equipment and have established special service groups to help users engineer their own data reduction systems.

Actual installations of this equipment have been made. Scheduled for installation in November at Esso Standard Oil Co.'s Bayway, N.J., refinery, is a digital logger built by Fischer & Porter, and claimed to be the first to be designed for a production process. Beckman has already delivered its first logger to an Esso Standard Oil Co. pilot plant at Baton Rouge, La., and has another one scheduled for another refinery early next year.

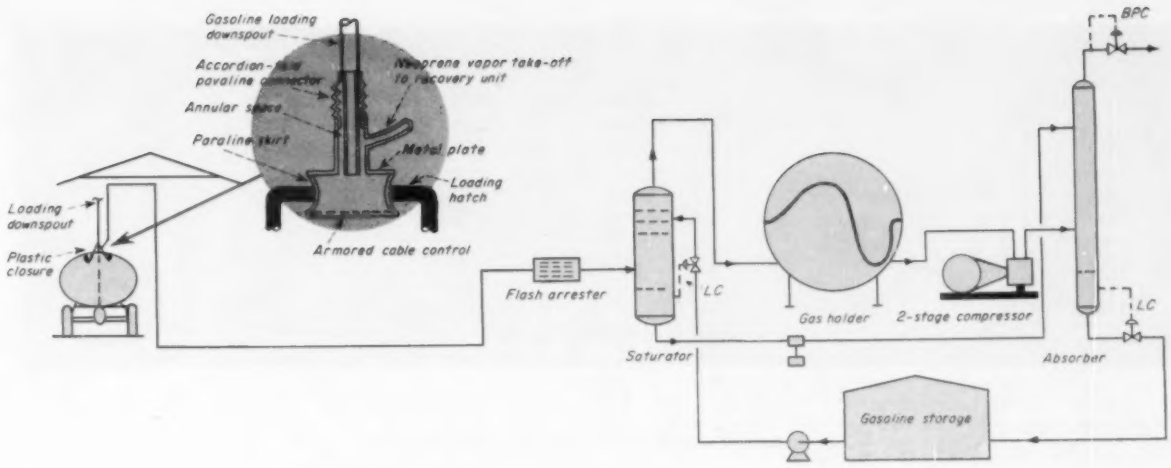
Several other major oil companies were indicating high interest in developing a place in their plants for these new instruments, conversations at the Instrument Conference clearly demonstrated.

Elimination of manual logging by the unit operator is one of the big selling points for the automatic loggers. Thus the operator is free for more processing supervision. Between logging intervals, the instrument can be used to scan inputs, reporting only selected or abnormal values, most important during periods of upset.

Logging speeds of up to 2000 points in 10 minutes are possible. However, for general purpose work, the logger can be set to operate at a rate of 100 points in 5 minutes. This allows the use of slower-acting components of more rugged construction with consequently less maintenance. At any speed the accuracy of ±0.25% of full scale is very high.

Costs vary to some extent. However, Fischer & Porter estimates that systems handling 50 to 500 inputs will run between $10,000 and $40,000, depending on the number of circuits and special accessories used. Beckman's selling price will be in the same range.

Payout, it is believed, can come in six months to a year, based on clerical savings alone. In addition, the manufacturers, point out, the devices do jobs that couldn't be done any other way. The data that has been accumulated in the instrument can be utilized in many ways heretofore not readily available. For example, if desired, data can be printed by a typewriter for later visual examination.



Here's a way to . . .

Cut Smog while Saving Product

As their part of the Los Angeles area petroleum industry's $25,000,000 stake in the continuing battle against smog, Standard Oil Co. of California plans a new $40,000 vapor recovery system on the gasoline loading rack at its Clearwater terminal near Compton, Calif. The system will be adopted at other Standard terminals as soon as it proves satisfactory.

Standard's unit simply seals off the point of contact between loading hose and tank truck. The vapor recovery system is a variation of the usual compression and absorption system used for refinery vapor and natural gasoline recovery. The fundamental differences are that the flow of vapors from truck loading is intermittent, and the air content of the vapor varies widely.

Principal equipment for the control of vapors during gasoline truck loading includes an expansible plastic seal between the terminal loading downspout and the filling hatch on the truck, a vapor saturator, a gas holder, a two-stage compressor, and a small absorption column.

The plastic seal consists of a flexible "Paraline" plastic skirt, flared at top and bottom. The bottom, or open end, of the skirt has its periphery connected to an armored cable which contracts the skirt to allow insertion into the loading hatch of the truck, and expands the skirt to form a vapor tight seal after insertion. On the top of the Paraline skirt is a metal plate.

The terminal loading downspout is connected to a flexible "accordion-fold" Paraline adapter which in turn connects to a "Koroseal" neck fitting onto the metal plate at the top of the Paraline skirt. An annular space within the Koroseal neck allows displaced vapors to escape through a neoprene side take-off line while the truck is being filled.

Displaced vapors from the filling operations enter a central header and are conducted to the saturator, a 24-in.-diameter column, 6 ft. tall with 30 in. of packing.

Gasoline from storage circulates through the saturator and contacts the vapor from the header to assure that all vapors discharged to the gas holder are essentially saturated and above the explosive range. The gasoline plus any absorbed vapors is sent to the absorber to act as sponge stock.

The gas holder—which receives saturated vapors from the saturator—gives a 10,000 cu. ft. surge capacity to permit the compressor and absorber to operate at constant flow rates.

Two stages of compression take vapors from the gas holder and send them to the absorber at 200 psi. Sponge stock from the saturator enters the absorber, a 12-in.-diameter column 12 ft. tall with 5 ft. of packing. The enriched sponge stock containing the absorbable hydrocarbon fractions from the compressed vapors then returns to the main gasoline storage tank. Air and a low percentage of non-condensables are discharged to the atmosphere.

The small volume of absorbed vapors—roughly 4 to 10 b/d—will not buildup noticeably in the 20-30,000-gal. main gasoline storage tanks.

Automatic instrumentation allowing the plant to operate without the attendance of a process operator is necessary to avoid excessive operating expenses arising due to the intermittent flow of recovered vapors.

A grid-type flame arrestor between the vapor recovery unit and the vapor take-off at the truck eliminates the possibility of flame transmission between them by cooling the advancing flame below combustion temperature.

An unattractive payout estimated to be 20 years—about five times that considered desirable — explains why the recovery of hydrocarbons from gasoline terminal loading operations has not been tried before. The main justification for the recovery unit is its contribution to the Los Angeles smog problem, rather than a matter of economics.

Flaring of vapors is even more unattractive than vapor recovery. A flare installation has no recovered product, hence no payout, and yet will cost up to $15,000 to install, costs money to operate, requires a constant pilot flare, and might go out, permitting vapors to escape into the atmosphere.

These installations are not part of the Los Angeles Air Pollution Control District (APCD) requirement that the petroleum industry install certain vapor control measures for gasoline and cracked stocks in storage, but are *voluntary* contributions toward smog control by the petroleum industry. As stated by P. S. Magruder, chairman of the Western Oil and Gas Assn. smoke and fumes committee, some kind of vapor recovery system will be installed by May 1, 1955, on every gasoline loading rack in Los Angeles county handling 20,000 gal. per day or more.

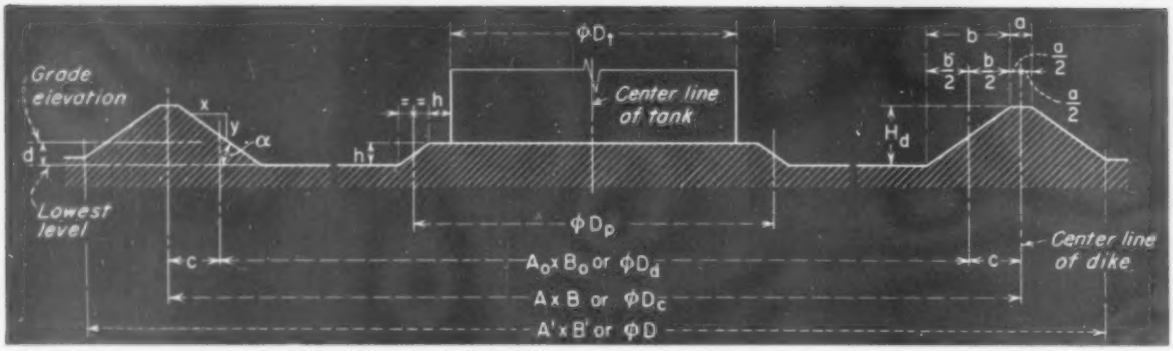


FIG. 1—Cross-section of typical dike-enclosure

For tank farm layout . . .

Short-cut Fire-Dike Design

By ROBERT KERN
Mechanical Engineer, London, Great Britain

A LARGE portion of the capital outlay of a refinery is expended in storage and off-site facilities. Consequently, accuracy and care in design are both essential to the most economical layout.

Here is a quick method for mapping out tank farm layouts for vertical cylindrical storage tanks. Lengthy calculations are avoided and accurate results are obtained for any shape of fire wall and earth-dike arrangements on either level or sloping ground.

Normally tankage is divided into storage for intermediate and final product. Work, or intermediate, tanks are placed nearest to their respective units to provide short suction lines and to simplify process line manifolding. Operating flexibility and simplicity are obtained by grouping storage tanks holding similar products and by arranging dikes, roads, fire roads and access ways between tanks so that the farm will be well organized. Tanks which hold high viscosity stocks should be arranged so that the shortest pipeline system can be provided for pumping operations.

Each tank or group of tanks should be surrounded by a dike when the safety of adjoining property, facilities, or waterways would be endangered by accidental discharge of the contents of the tank concerned. Crude oil tanks normally have diked enclosures with a capacity equal to the full contents of the tank or tanks enclosed, since crude oils usually contain some water and there is boil-over danger when fire occurs. Tanks which hold products not prone to boil-over usually have diked enclosures equal to the full capacity of the largest tank plus 10% of the combined capacity of all the other tanks within the same enclosure. Spacing between storage tanks is dependent upon local regulations and individual judgment. However the National Fire Protection Association[1] and the National Board of Fire Underwriters[2] have published recommended safety precautions concerning tank spacing.

Dikes may be of any shape, depending upon available space and geographical conditions. They may take advantage of natural topographical features. Square and rectangular dikes are used most often since they are easy to arrange and construct, and produce a neat and simple layout.

Earth-dike height and slope are limited by earth conditions, but in the construction of the dike, 2 to 6 ft. height is normally used. Where only limited space is available or excessive volumes have to be enclosed, the height goes up to 8 or even 10 ft.

Dike Requirement Calculations

Fig. 1 shows a typical cross-section through an earth-dike and storage tank. Derivations based on this figure have been simplified by replacing the sloping inside dike wall with its equivalent in a vertical wall by using the average inside diameter (or length and width). This greatly simplifies all calculations since the following derivations apply equally to vertical or sloped wall dikes.

The required free volume for a circular dike enclosing a cylindrical tank having a circular tank pad is:

$$V_d = kV_t + V_p \text{ cu. ft.}$$

where:

$$V_p = D_p^2 \pi h/4 \text{ cu. ft.}$$

The proportion of the tank volume which is required for dike capacity is shown by k. If $k = 1$, the total volume of the tank has to be enclosed by a dike.

The diameter of the free area for the circular dike is:

$$D_d = \sqrt{4V_d/\pi H_d} \text{ ft.}$$

The diameter enclosed by the center-line of a circular dike is:

$$D_c = D_d + 2c \text{ ft.}$$

The diameter of the total ground area covered by the circular enclosure is:

$$D = D_d + 4c + b \text{ ft.}$$

Dimensions for the free area enclosed by square and rectangular dikes are as follows:

$V_d = A_o B_o H_d$ cu. ft. when rectangular

where:

$A_o = B_o$ when dike is square

Where concrete, brick, or other vertical dikes are employed, the values of A_o and B_o denote the inside dimensions of the vertical walls.

Dimensions for the area enclosed by rectangular or square dike center-lines are:

$A = A_o + 2c$ ft.
$B = B_o + 2c$ ft.

Dimensions for the total ground area covered by the enclosure and the dike walls are:

$A' = A_o + 4c + b$ ft.
$B' = B_o + 4c + b$ ft.

where:

$c = a/2 + b/2$ ft. for circular, square, or rectangular dikes
$b = (x/y)H_d = H_d/\tan\alpha$ ft. for sloping dike walls.
$b = 0$ for vertical dike walls, circular or otherwise.
a = dike walkway width, ft.

Since a, x, and y are specified, c remains constant for a given dike height and material.

Fig. 2 illustrates typical earth-dike cross-sectional dimensions drawn on arithmetic graph paper. A dike section is drawn with the desired slope* and walkway width,** a, measured at the top of the dike. Along the H_d line the values of b and $2c$ can be read. A 1:1 and a 1:1.5 slope with a walkway width of 3 ft. were used for Fig. 2. Dike section dimensions are easily obtained for any other slope drawn from point "P." However, the scale for $2c$ must be revised if a is other than 3 ft.

An example of the use of Fig. 2 is as follows:

Dike wall slope = 1 : 1.5
H_d = 8 ft., assumed
b = 12 ft., read on top scale
$2c$ = 15 ft., read on bottom scale

Constructing Sizing Graphs

A quick check on areas and dimensions for preliminary layout work in determining dike dimensions (neglecting the volume occupied by the tank pad) is given by:

$K = kH_t/H_d = F_d/F_t$

where the symbol K represents the ratio of free cross-sectional area of the diked enclosure to that of the tank volume which must be protected by the enclosure.

Similarly, the relationship between the tank diameter and square dike length and width for the enclosed free area is:

$A_o = D_t\sqrt{\pi K/4}$ ft. for inside dike dimensions
$A = B = D_t\sqrt{\pi K/4} + 2c$ ft. for dimensions to dike center-lines
$A' = B' = D_t\sqrt{\pi K/4} + 4c + b$ ft. for dike outside dimensions

For the case of circular dikes:

$D_d = D_t\sqrt{K}$ ft. for inside dike dimensions
$D_c = D_t\sqrt{K} + 2c$ ft. for dimensions to dike center-lines
$D = D_t\sqrt{K} + 4c + b$ ft. for dike outside dimensions

For dike layouts other than circular or square, the calculations are basically the same. In a parallelogram arrangement (including the right-parallelogram or rectangle) A becomes the length of one chosen base line and B (perpendicular to A) will be the height.

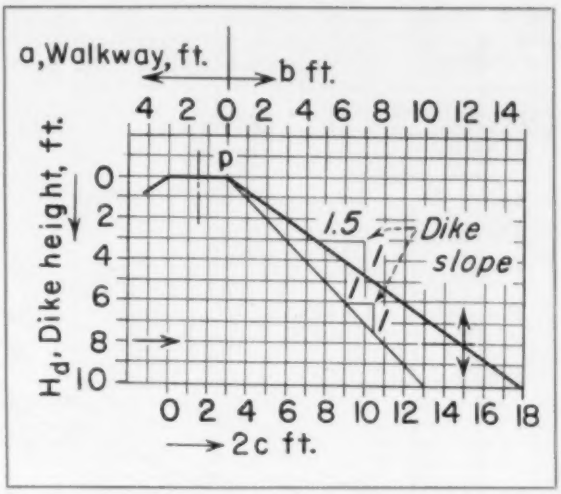


FIG. 2—Cross-section of typical earth-dike wall

The above free area relations, plus the dike volume relationships developed earlier, form the bases for the logarithmic diagrams Figs. 3 and 4.

On Fig. 3 the required free dike volumes are plotted against the dimensions of $A_o = B_o$. The parallel diagonal lines on the graph represent dike heights for H_d from 2 to 10 ft. The right side ordinate of Fig. 3 shows the diameter D_d for circular ehclosure. The basis of this scale is that for a square and circle of equal area: the ratio of the diameter of the circle and the side of the square is a constant. This constant is shown to be $\sqrt{\pi/4}$ as follows:

$F_d = A_o^2 = D_d^2\pi/4$

therefore:

$A_o/D_d = \sqrt{\pi/4}$

which also gives the relative position of the D_d and the A_o scales to each other. The value of D_d must be increased by $2c$ to obtain the diameter to the center-line of the dike wall, and must be increased by $4c + b$ to obtain the total dike diameter including the sloping outside walls of the dike.

Fig. 4 is used for dimensions of rectangular areas and

Table 1—Nomenclature

V_t	= Volume of storage tank, cu. ft.
V_p	= Volume of circular tank pad, cu. ft.
V_d	= Free volume enclosed by dike or retaining wall, cu. ft.
F_t	= Storage tank cross-sectional area, sq. ft.
F_d	= Cross-sectional area of free dike enclosure, sq. ft.
h	= Height of circular tank pad, ft.
H_t	= Height of storage tank, ft.
H_d	= Height of dike or retaining wall, ft.
D_t	= Diameter of storage tank, ft.
D_p	= Diameter of circular tank pad, ft.
D_d	= Diameter of inside free dike or retaining wall area, ft.
D_c	= Diameter to center-line of dike or retaining wall area, ft.
D	= Diameter to outside foot of dike or retaining wall, ft.
A_o, B_o	= Length and width of free dike area, ft.
A, B	= Length and width of dike or retaining wall center-lines, ft.
A', B'	= Length and width to outside foot, of dike or retaining wall, ft.
k	= Dimensions less capacity factor.
K	= Dimensionless area factor, F_d/F_t, or kH_t/H_d.
a, b, c, x, y	= See Fig. 1, dimensions in ft.
1 Barrel	= 5.614 cu. ft.

* Dike wall slope is dependent upon the natural angle of repose for the earth used.

** Editor's note: While the author of this paper uses a 3 ft. earth-dike walkway, the NFPA[1] recommends a 2 ft. minimum walkway for earth-dikes 3 ft. or more high.

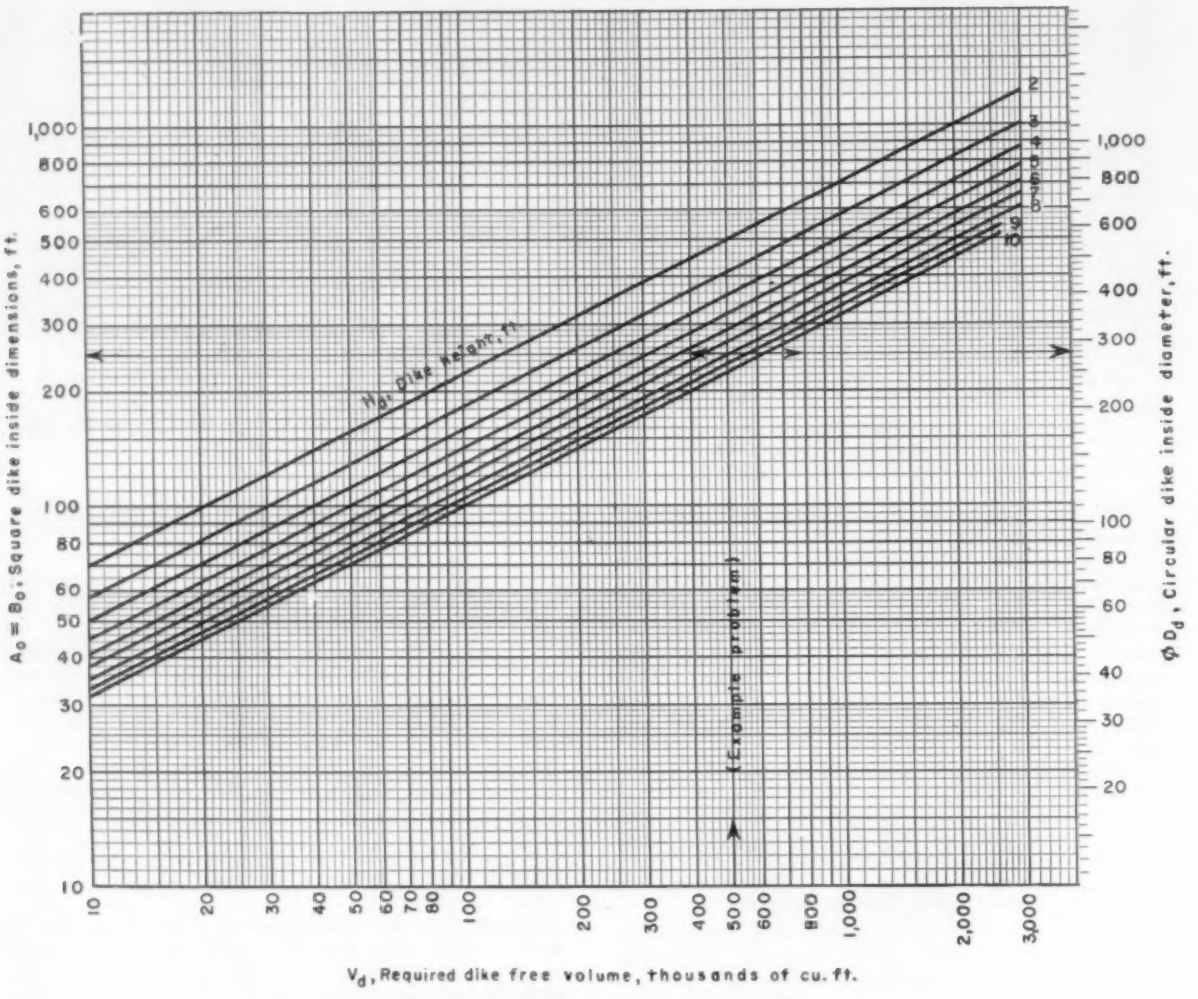


FIG. 3—Dike dimensions, square and circular

for variations in dike dimensions during layout work without altering the required dike volume once it has been calculated or plotted. The axes of this diagram represent the length and width of a rectangularly shaped enclosure.

The sloped parallel lines on Fig. 4 are lines of constant area. Perpendicular to these constant area lines, the $A = B$ line (which is also the $A' = B'$ line) is drawn. Points of intersection on this line are the points of square areas. In making a layout, alternative dimensions are often required for a certain tank farm area. Selecting these alternative dimensions is facilitated by these constant area lines, as will be shown in the illustrative example to follow.

An additional diagram, Fig. 5, plotting tank diameters and U. S. capacities is appended to facilitate tank size selection and for use in conjunction with Figs. 3 and 4. The parallel lines of Fig. 5 represent tank heights. Diameters and tank heights can be chosen for any required tank capacity. The ordinate V_d gives the approximate value of the required free dike volume for crude petroleum tankage, including 10% for safety and 10% for estimated tank pad volume. V_d from Fig. 5 is then used in Fig. 3 to obtain dike dimensions. In cases where the entire volume contents of tanks do not need to be protected by enclosures the dike free volumes must be calculated according to the specific requirements for each individual case.

Using the Graphs

The following illustrative examples will indicate the method for determining dike dimensions by use of the preceding Figs. 1 to 5.

1. Level ground storage, square earth-dike enclosure:

a. Crude petroleum tank capacity = approx. 417,000 cu. ft.
b. Dike free volume required = V_d = 417,000 (1.0 + 0.1 + 0.1) = 500,000 cu. ft.
c. Assume H_d = 8 ft. for first estimation.
d. From Fig. 3, for V_d = 500,000, $A_o = B_o$ = 250 ft.
e. From Fig. 4, for $A = A_o$, the enclosed inside free area, F_d, equals 62,500 sq. ft.
f. Determine dike slope and walkway width, and construct a cross-sectional drawing similar to Fig. 2. For this case a = 3 ft. and the slope will be 1 : 1.5.
g. From Fig. 2, read the values for b and $2c$ for H_d = 8 ft. For this case, b = 12 ft. and $2c$ = 15 ft.
h. Calculate dike dimensions as follows:
$A = B = A_o + 2c = 250 + 15 = 265$ ft. to dike center-lines.
$A' = B' = A_o + 4c + b = 250 + 30 + 12 = 292$ ft. to outside of dike.
i. From Fig. 4 determine the diked enclosure areas for A and A' on the $A = B$ line. For A = 265 ft., diked area = 70,000 sq. ft. For A' = 292 ft., diked area = 85,300 sq. ft.

2. Level ground storage, rectangular earth-dike:

a. Working with the same problem as for the square dike, the same steps are taken in order to find the enclosed areas for the dike.
b. Assume that in the final layout, the diked enclosure is limited to a width of no more than a total of 200 ft.
c. On Fig. 4, follow a constant area line of 85,300 sq. ft. until it intersects with a width value of $B' = 200$ ft. on the horizontal scale. Then read the corresponding value for A' on the vertical scale, equal to approx. 430 ft. This value of $A' = 430$ ft. represents the total dike length required when the width is limited to only 200 ft.

3. Level ground storage, circular earth-dike:

a. The value of $V_d = 500{,}000$ cu. ft. obtained from the square earth-dike example is inserted into Fig. 3. Reading vertically until the $H_d = 8$ ft. line is reached the inside diameter of the diked enclosure is read from the right-hand vertical scale as $D_d = 283$ ft.
b. As for the square dike example, Fig. 2 is constructed for $a = 3$, and slope = 1 : 1.5.
c. From Fig. 2, $2c = 15$ ft. and $b = 12$ ft.
d. $D_c = D_d + 2c = 283 + 15 = 298$ ft. diameter to dike center-line. $D = D_d + 4c + b = 283 + 30 + 12 = 325$ ft. diameter to outside of dike.
e. From Fig. 4, using the values of A corresponding to the values of D on Fig. 3, the diked enclosure areas are found on the $A = B$ line. For $D_c = 298$ ft., the diked area = 70,000 sq. ft. For $D = 325$ ft., the diked area = 85,300 sq. ft.

To estimate overall space requirements for total refinery tankage, Fig. 3 is entered with the total required dike capacity value, calculated from the total volume of the storage tanks multiplied by the capacity factor k. The average dike height is estimated for Fig. 3, and projected to Fig. 4 to read the required minimum enclosure area on the $A = B$ line. Variations in length and width of the total area can also be obtained using this line. Provide allowances for spacing of roads and dike walls.

4. Sloping ground storage:

a. When arranging fire-walls on hilly ground, vertical circular construction is usually more economical than sloped earth wall construction.
b. Storage tank size = 80 ft. diameter by 30 ft. high.
c. Ground slope = 10 : 1.
d. $V_t = 150{,}000$ cu. ft. from Fig. 5.
e. $V_d = 0.5\ V_t + 10\%$ (for tank pad) = 82,500 cu. ft.
f. Assume $H_d = 3.5$ ft.
g. From Fig. 3, for $H_d = 3.5$ ft. and $V_d = 82{,}500$ cu. ft., $D_d = 175$ ft.
h. Draw a continuous slope line perpendicular to the contour lines through the tank center as shown in Fig. 6.
i. Choose as a reference point the intersection of one of the contour lines and the slope line. The one chosen for this example is at elevation 20 ft.
j. Draw the diameter D_d through the above reference point.
k. The required elevation to the top of the dike is: Elevation = 20 + 3.5 = 23.5 ft.

The application of these graphs is the same whether the dike layout is in squares, rectangles, parallelograms or circles, and whether the site is level or sloping.

It must be mentioned that this method of dike dimen-

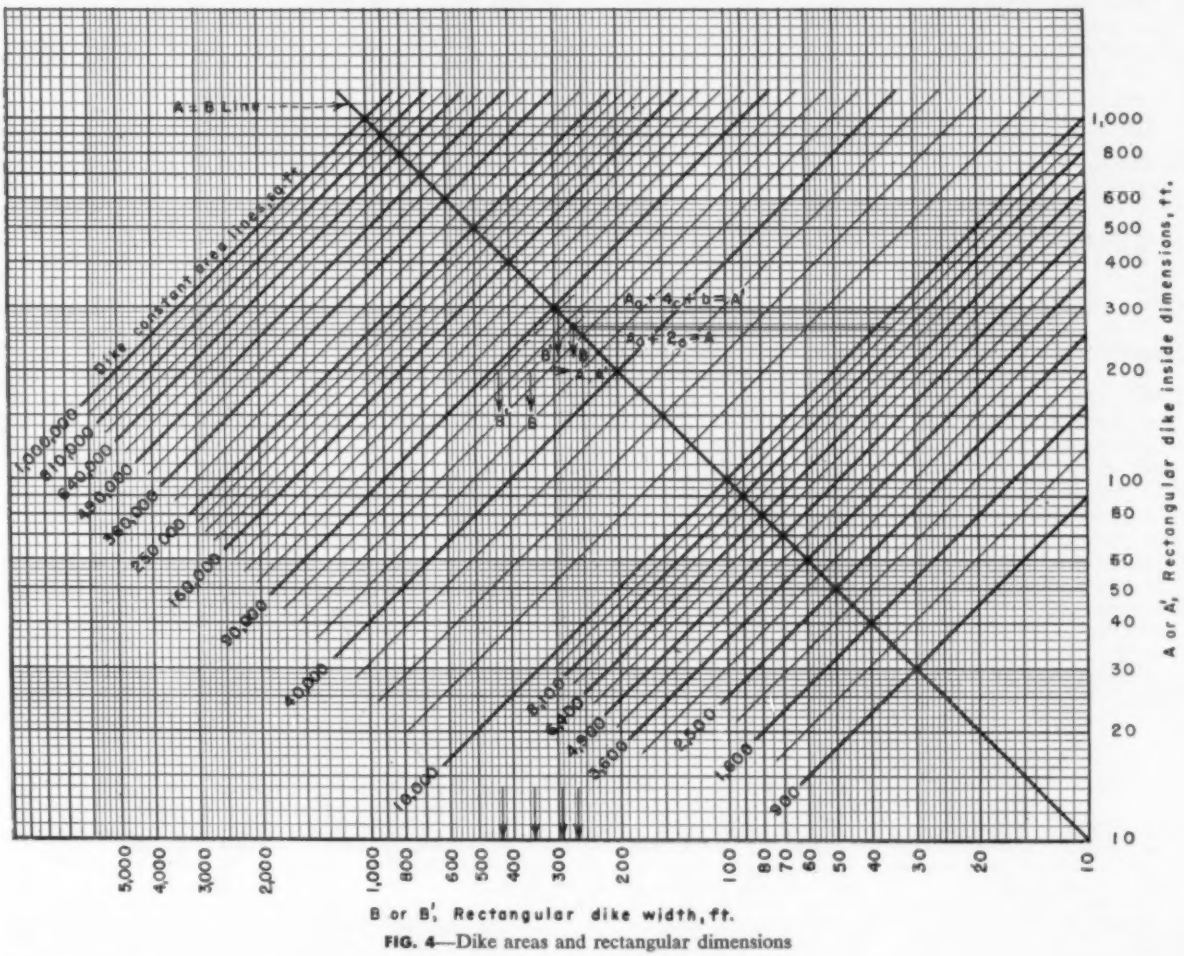
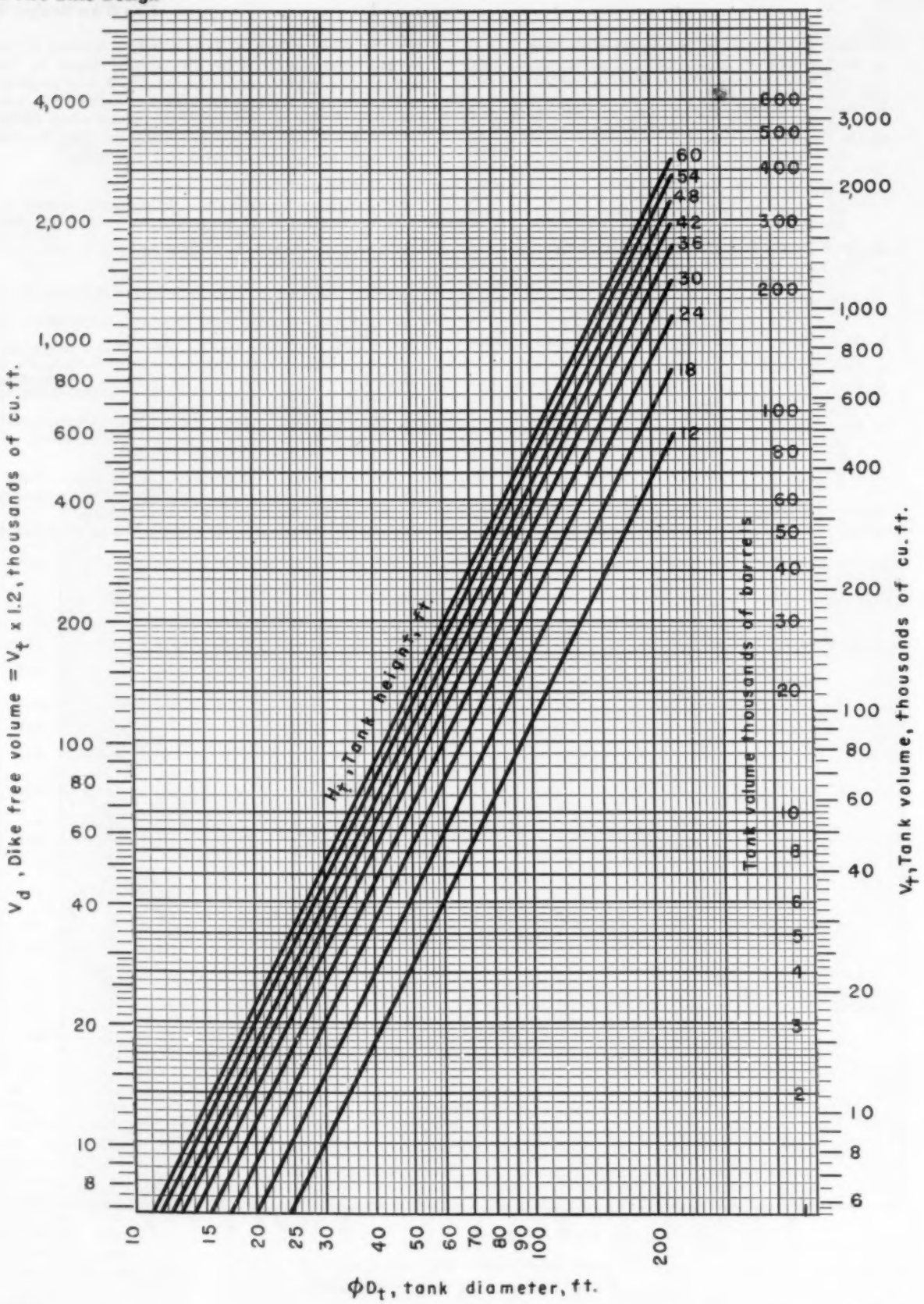


FIG. 4—Dike areas and rectangular dimensions


V_d, Dike free volume = V_t x 1.2, thousands of cu. ft.
4,000
2,000
1,000
800
600
400
200
100
80
60
40
20
10
8
H_t, Tank height, ft.
60
54
48
42
36
30
24
18
12
Tank volume thousands of barrels
600
500
400
300
200
100
80
60
50
40
30
20
10
8
6
5
4
3
2
1
V_t, Tank volume, thousands of cu. ft.
3,000
2,000
1,000
800
600
400
200
100
80
60
40
20
10
8
6
10
15
20
25
30
40
50
60
70
80
90
100
200
ϕD_t, tank diameter, ft.

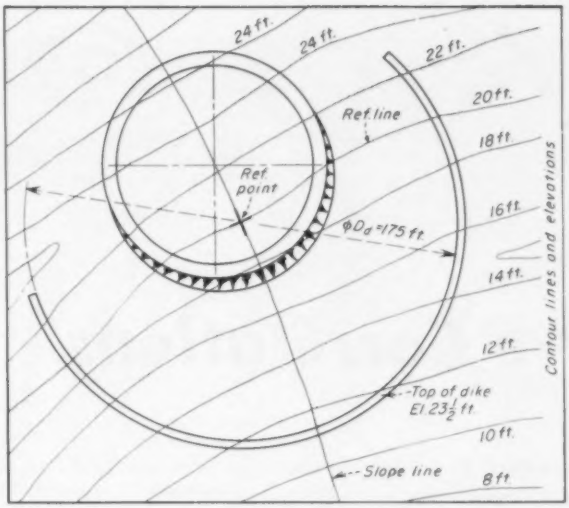


FIG. 6—Dike sizing on sloping ground

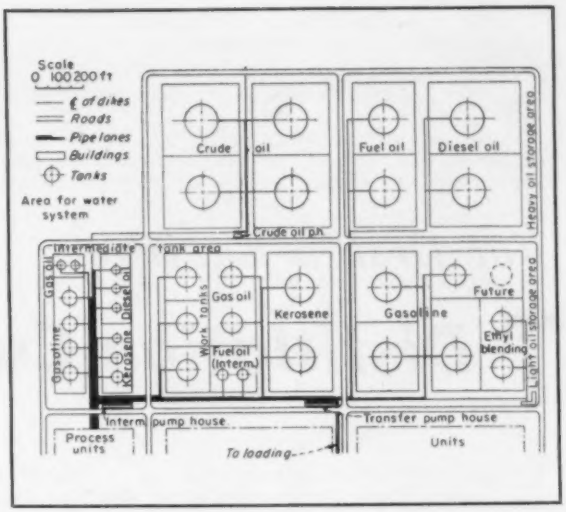


FIG. 7—Typical tank form layout

sioning for sloping ground is theoretically accurate while the dike remains a full enclosure. In the case of an "open" retaining wall, semicircular as shown in Fig. 6, and within practical design requirements (limitations of slope and maximum wall height) this method gives a conservative approximation because the enclosed volume will be larger than that actually required for the enclosed tank.

Layout Considerations

Having settled dike dimensions, tanks are grouped, pipe lines arranged and pump houses located on preliminary sketches.

In some cases the prevailing wind direction should also be taken into account in arranging a tank farm layout protective against increased fire hazard caused by wind.

A road system is arranged to allow access to units, buildings and tank areas. From the standpoint of fire protection a suitable length of block in a storage tank area enclosed by roads is a maximum of 600 ft. An area greater than this should be divided by fire roads. Catwalks are provided over dike walls for access to tanks, and steps or ladders are furnished for high retaining walls to allow escape from the enclosure during an emergency.

The type of dike drainage system is dictated by weather, soil conditions, cost, and local regulations. Underground lines would be the most expensive design. An open concrete or earth culvert arrangement beside the roads with dike drain pipes can also be used.

Before commencing the earthwork on a levelled plant site it is advisable to choose an economical grade elevation where the amount of earthwork will be at a minimum. This can be calculated on the following basis: after establishing the lowest level of the entire tank farm area (see Fig. 1) all earth quantities above this level necessitated by roads, dikes, tank pads, etc., are summarized. The total of these earth quantities (cu. ft.) divided by the whole area concerned (sq. ft.) gives an average height and also gives the distance d in ft. of the best grade elevation from the lowest level. A good estimate of the volume of earth required to build up the tank farm can be obtained by taking 55% of the calculated total earth volume existing above the lowest level.

FIG. 5—Dike free volume versus storage tank size

Tank Farm Layout Example

Fig. 7 shows an actual tank farm layout on a rectangular refinery area, where 17 intermediate tanks of various sizes and 18 tanks for final products have been arranged on the previously described basis with dike capacities 1.1 times tank volumes. Lines from process units aproached approximately the middle of the unit plot which suggested the idea of splitting the intermediate tank area into two. This established a straight run for all pipes between the process units and intermediate tank area. Gasoline and kerosine tanks have been placed nearer to the process units because more lines were connected to them than to the gas oil and diesel oil tanks. Blending and transferring into the final storage tanks is done by pumps situated in the intermediate pump house.

Storage tanks have been grouped in heavy and light oil areas. Main pipe banks leading to them were located on one side of the roads. Crude oil lines run in the center of their service area and a similar arrangement has been made for the four gasoline tanks.

The tank area has been divided by roads into four congruent rectangules and dikes were arranged within these quarter areas. A constant dike height of 8 ft. was chosen. Tanks and dikes are in line. Pump houses are beside the main roads at locations near the main piping junctions.

This layout, with the flow diagrams, facilitates the detail layout work, the estimation of pipe quantities, and the calculation of friction losses and pipe expansions. It indicates also the occupied space to leave clear for electrical trenches, underground and other piping and equipment. The layout determines road and pipe crossings, culverts, pipe sleeve and pipe support requirements. Finally it gives a guide for estimating the civil engineering work involved.

Acknowledgment

The author expresses his thanks to the Kellogg International Corp. for permission to publish this article.

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(2) "Standards of the National Board of Fire Underwriters for the Storage, Handling and Use of Flammable Liquids" July, 1954, NBFU 30, National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

For Design Engineers

Distillation Curve Correlations

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University of Texas

EXISTING correlations between ASTM and TBP (true boiling point) distillation analyses for distillation slopes and 50% temperature points have at best been sketchy and prone to large errors.

Here is a new correlation based on extensive distillations at both atmospheric and subatmospheric pressures of several typical crude and distillate stocks.

The process design engineer in petroleum refining is faced with the necessity of using a wide variety of data in designing equipment to be used for processing oils. The nature of the various compounds contained in petroleum oils requires a number of different test methods and conditions be used in evaluation of the properties of the oils and the stocks obtained from them.

In laboratory distillation a material boiling above 700°F. requires the use of vacuum because of thermal instability and cracking around and above that temperature. Materials boiling below 700°F. nominally can be distilled at atmospheric pressure.

Thus the engineer may be supplied with analytical and evaluation data, some of which is determined at atmospheric pressure and others determined at subatmospheric pressure.

In addition to the differences in conditions at which the tests may be conducted, different types of test methods may be used. Fractionating distillations are all classed as true boiling point distillations regardless of the reflux ratio, number of plates or stages or efficiency of the stages.

This is unfortunate in that some so-called TBP distillations produce data more nearly like those produced from Engler type (non-fractionating) distillations than those from the actual TBP method. On the other hand, some modified Engler methods produce data intermediate in characteristics between the TBP and Engler methods.

These and other factors relative to analytical procedures result in each company—or even company division in some cases—establishing their own analytical distillation procedures for evaluation of crude oils and petroleum oil fractions. Quantitative use of the evaluation data in process design and product specification then requires each group using different analytical procedures to have sufficient experience in use of such data to enable them to produce reasonably accurate results.

Thus the relations between the analytical data and the design data are correlated and appear as charts, curves, graphs, nomographs, tables, etc., in the particular company design data book—the individual bible of the design engineer.

These relations are not applicable generally because they are good only for the data produced by the particular company — standardized procedures and the types of stocks commonly processed by the company.

Therefore, any correlation based upon data derived from special procedures and methods in a strict sense applies only to data derived in the same manner. Generalized correlations represent only approximations, in some cases close approximations, of the experimental data.

The experimental data used in the correlations presented here were determined from a number of petroleum oil stocks and fractions including crude oils, heavy naphthas, reduced crudes and both cracked and virgin stocks.[6] These data are presented in Table 1. The Engler type or ASTM distillations were conducted at pressures of 50, 100, 200, 400, and 760 mm. Hg in the equipment and using essentially the same method as the ASTM Distillation Method D 1160-52T.[1] The TBP distillations were run at 50 mm. Hg pressure in a fifteen-plate Oldershaw[10] column.

Correlations: Because of the necessity of using the analytical data in design calculation a number of cor-

Meet The Author

Matthew Van Winkle, Professor of Chemical Engineering at the University of Texas, received his B.S. in Chemical Engineering from Purdue University in 1933 and his M.S. from the University of Michigan in 1945. He was engaged 7 years in research and development with Cities Service Oil and Refining Co., and 1 year with Standard Oil Co.-Ind. He taught 2 years at Pennsylvania State College and 4 years at the University of Michigan before joining the University of Texas in 1947. At Texas he has been the Chairman of the Dept. of Chemical Engineering, and is presently professor of graduate and undergraduate courses. A registered professional engineer in Texas, he is actively engaged in industrial consulting for the chemical and oil industries.

Table 1—TBP and ASTM 50% Temperatures and 10-70% Slopes

Stock No.	50% T °F. 760 mm ASTM	760 mm TBP*	400 mm ASTM	400 mm TBP*	200 mm ASTM	200 mm TBP*	100 mm ASTM	100 mm TBP*	50 mm ASTM	50 mm TBP	10-70% Slopes 760 mm ASTM	760 mm TBP	400 mm ASTM	400 mm TBP	200 mm ASTM	200 mm TBP	100 mm ASTM	100 mm TBP	50 mm ASTM	50 mm TBP
1	348	362	308	319	271	279	239	243	211	210	0.3	0.85	0.3	0.83	0.3	0.81	0.3	0.80	0.3	0.76
2	386	390	347	353	310	310	274	274	241	240	0.4	0.90	0.4	0.88	0.4	0.84	0.4	0.81	0.4	0.78
3	412	422	371	377	335	334	298	296	263	262	1.1	1.97	1.1	1.92	1.1	1.80	1.0	1.77	1.1	1.70
4	413	413	363	368	323	325	288	288	257	254	1.6	2.42	1.6	2.38	1.5	2.27	1.5	2.23	1.5	2.13
5	429	451	384	401	348	351	310	313	275	273	1.4	2.2	1.3	2.08	1.3	1.97	1.3	1.93	1.3	1.87
6	451	453	405	402	363	361	321	323	289	288	0.8	1.63	0.8	1.45	0.8	1.25	0.8	1.22	0.8	1.15
7	455	571	411	426	369	380	335	342	304	306	0.9	1.72	0.9	1.67	0.9	1.57	0.9	1.53	0.9	1.47
8	456	458	409	412	362	366	325	328	293	293	1.5	2.66	1.4	2.58	1.4	2.44	1.4	2.38	1.4	2.30
9	489	500	437	453	398	405	363	366	328	329	1.7	2.72	1.6	2.61	1.6	2.47	1.6	2.45	1.6	2.35
10	493	512	444	465	401	416	365	378	337	340	2.3	3.62	2.3	3.46	2.2	3.30	2.2	3.24	2.2	3.12
11	504	518	458	469	419	421	379	382	345	345	2.9	3.85	2.8	3.68	2.7	3.50	2.7	3.43	2.7	3.32
12	507	519	456	470	418	422	380	383	343	346	2.2	3.48	2.1	3.33	2.1	3.17	2.1	3.10	2.1	3.00
13	517	522	470	483	426	434	387	395	352	357	1.3	2.27	1.3	2.15	1.3	2.07	1.3	2.02	1.2	1.95
14	523	538	477	489	431	440	392	401	356	362	1.4	2.44	1.4	2.34	1.4	2.23	1.4	2.18	1.3	2.10
15	523	524	473	485	429	436	389	397	356	359	1.4	2.47	1.4	2.30	1.4	2.20	1.4	2.15	1.3	2.07
16	535	524	486	485	439	436	395	397	357	359	4.3	5.04	4.3	4.81	4.2	4.60	4.1	4.50	4.2	4.35
17	538	555	489	505	445	455	406	416	372	377	1.7	2.80	1.7	2.70	1.7	2.57	1.6	2.52	1.6	2.44
18	575	597	524	545	482	493	439	453	405	413	1.2	2.23	1.3	2.11	1.3	2.05	1.2	2.00	1.2	1.93
19	580	600	529	547	479	496	439	456	407	416	3.2	4.86	3.2	4.66	3.3	4.47	3.2	4.37	3.2	4.21
20	584	604	532	552	488	500	449	460	413	420	2.7	5.07	2.8	4.84	2.8	4.68	2.7	4.57	2.8	4.41
21	629	650	573	594	529	542	487	500	452	458	2.0	3.50	2.0	3.33	2.1	3.22	2.1	3.15	2.1	3.05
22	635	656	582	600	537	548	491	506	455	464	—	4.85	3.7	4.61	3.8	4.45	3.8	4.33	3.7	4.20
23	677	725	635	667	588	613	545	568	508	525	—	4.90	3.1	4.63	3.2	4.51	3.3	4.35	3.3	4.25
24	667	712	620	655	573	600	531	557	494	574	1.4	2.80	1.4	2.65	1.4	2.58	1.4	2.50	1.4	2.44
25	696	775	663	714	618	660	585	612	549	568	—	6.00	—	5.74	4.4	5.60	4.6	5.38	4.6	5.25
26	714	811	691	749	654	691	612	643	573	599	—	5.50	—	5.21	—	5.07	3.2	4.86	3.3	4.75
27	710	761	661	706	618	650	574	604	541	560	1.6	3.91	1.8	3.72	2.1	3.65	2.2	3.50	2.2	3.43
28	730	813	682	748	641	696	597	643	561	601	2.1	4.20	2.2	3.92	2.4	3.88	2.6	3.73	2.6	3.62

*Calculated

relations have been devised and published in the past. The majority of the correlations apply only to atmospheric pressure data and were devised for the purpose of relating equilibrium flash vaporization data with ASTM and TBP analytical distillation data.

Nelson and Harvey[5] related the ASTM 50% temperatures to equilibrium flash vaporization 50% temperatures, and TBP 50% temperatures to flash 50% temperatures. Also, they related the 10%-70% slopes of the ASTM, TBP, and flash curves. Nelson[4] gives a relation between ASTM and TBP 50% temperatures and 20%-80% slopes. Geddes[3] related ASTM and TBP 50% temperatures and other vol-% temperatures. Edmister and Pollock[2] published relations between ASTM and flash curves and also relations between ASTM and TBP 50% temperatures and incremental slopes of the distillation curves. Packie[11] correlated the slopes and boiling temperatures of the two types of curves.

All of these correlations were based on atmospheric pressure data with the exception of a few points determined at pressures above atmospheric. Very little if any data are reported at subatmospheric pressure.

Okamoto and Van Winkle[7, 8] have related subatmospheric flash distillation curves with TBP curves through 50% temperature and slope correlations. The same authors[9] have presented experimental data and correlations for subatmospheric flash distillations and atmospheric ASTM distillations.

While it is possible to use the atmospheric relations to predict either ASTM or TBP from the other analytical distillation data, it is necessary that some knowledge of the interrelationships of the characteristics of the analytical distillation curves be developed which will enable transposition of data from subatmospheric to atmospheric data and from one type of curve to the other. Oehler[6] presented a relation between the TBP 50 mm. Hg 50% temperature and ASTM 50% temperature at various subatmospheric pressures.

The correlations shown in Figs. 1 to 5 were developed, based upon the experimental ASTM vacuum distillation and the 50 mm. TBP distillation data.

Using the vapor pressure charts for hydrocarbon oils, the 10%, 50%, and 70% boiling temperatures for the TBP curves were determined at pressures of 100, 200, 400, and 760 mm. Hg based upon the experimental 50 mm. Hg TBP distillation curves. The 10%-70% slopes were then calculated for the ASTM and TBP curves at the different pressures.

Fig. 1 represents a plot of ASTM atmospheric pressure 10%-70% slope versus the TBP 10%-70% slopes at various pressures.

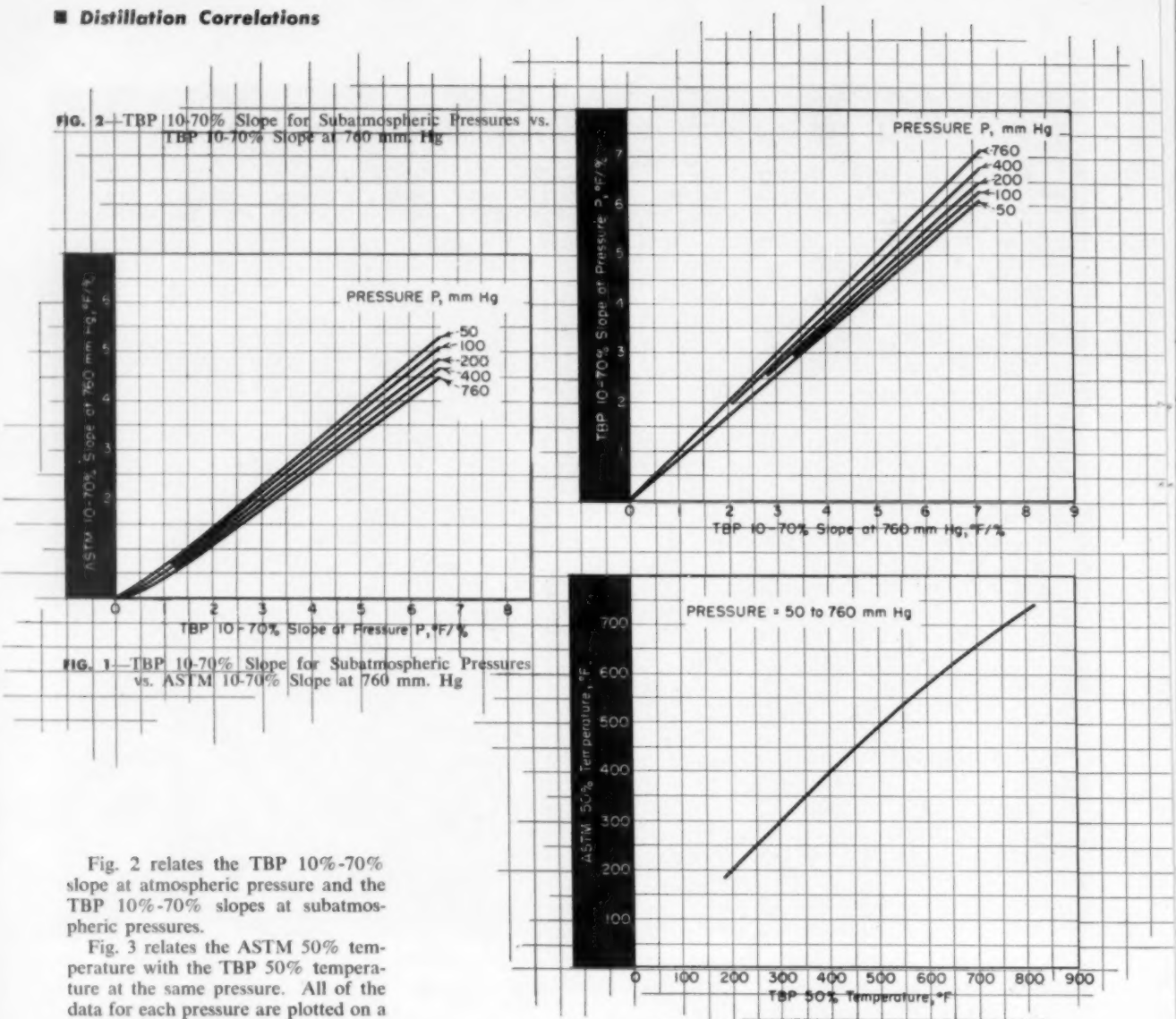

FIG. 2—TBP 10-70% Slope for Subatmospheric Pressures vs. TBP 10-70% Slope at 760 mm. Hg

FIG. 1—TBP 10-70% Slope for Subatmospheric Pressures vs. ASTM 10-70% Slope at 760 mm. Hg

FIG. 3—ASTM 50% Temperature vs. TBP 50% Temperature at the Same Pressure (from 50 to 760 mm. Hg)

Fig. 2 relates the TBP 10%-70% slope at atmospheric pressure and the TBP 10%-70% slopes at subatmospheric pressures.

Fig. 3 relates the ASTM 50% temperature with the TBP 50% temperature at the same pressure. All of the data for each pressure are plotted on a single smooth curve.

Fig. 4 represents a plot of ASTM 50% temperatures at atmospheric pressure versus TBP 50% temperatures at atmospheric and subatmospheric pressures.

Fig. 5 relates the TBP 50% temperatures at the various pressures.

Discussion: Comparison of the predicted 760 mm. ASTM 10%-70% slopes with the 760 mm. TBP 10%-70% slopes derived from the Nelson and Harvey correlation[5] and by the correlation presented in Fig. 1 indicates a slightly better agreement is obtained by use of the latter.

In certain cases neither correlation gives agreement with the experimental results. This occurs in the cases of the higher boiling stocks having higher slope values. This was also noted by Nelson and Harvey.

The reason for this is possible cracking of the material being distilled in the ASTM method or a lower rate of distillation because of the higher boiling materials causing greater induced reflux. This would tend to increase fractionation thereby increasing the slope of the ASTM curve.

The present correlation reproduces the data, with the exceptions noted, with an average deviation of approximately 3% and a maximum deviation of approximately 20%.

The subatmospheric data are reproduced on Fig. 2 (again with the noted exceptions) with an average deviation of approximately 5% and a maximum deviation of approximately 20%. No comparison with other published correlations is possible since none are available.

Fig. 2 reproduces the data with an average deviation of approximately 2% and a maximum deviation of 5%. Comparison with the prediction of the ASTM 50% temperature indicates about the same accuracy for the two relations, with Fig. 3 giving slightly better results. This is to be expected since the correlation represents a plot of the data.

The Edmister and Pollock[2] correlation of the 50% ASTM and TBP temperatures gives slightly higher values for the ASTM 50% temperatures at higher temperature and slightly lower values at the lower tem-

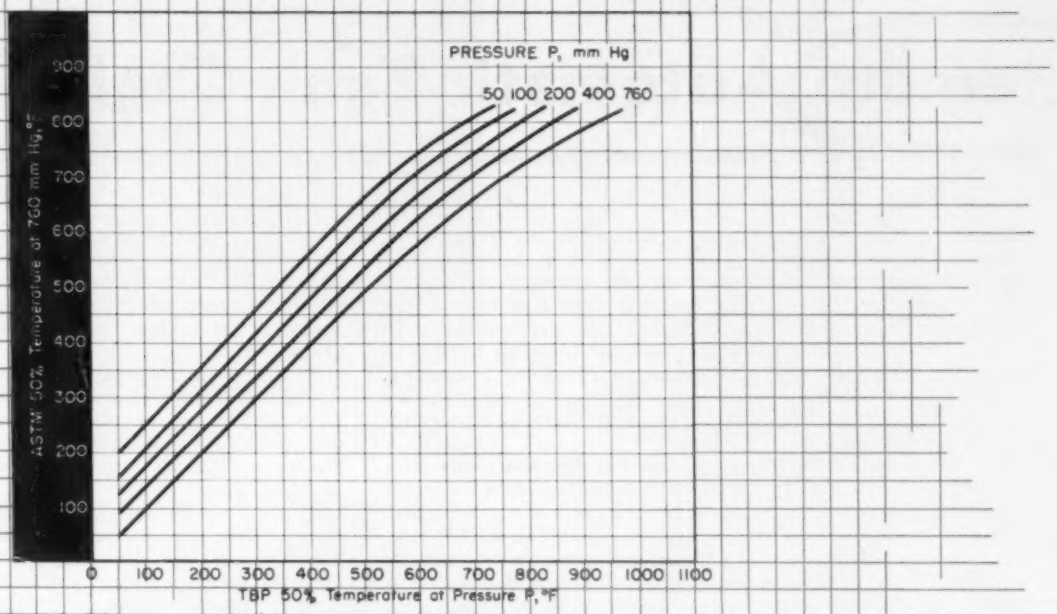

FIG. 4—TBP 50% Temperature at Subatmospheric Pressures vs. ASTM 50% Temperature at 760 mm. Hg

peratures. The variation is not more than about 2%, which is well within the expected accuracy of such correlations.

Fig. 5 was plotted from vapor pressure charts for the hydrocarbons and of course is subject to the same degree of accuracy.

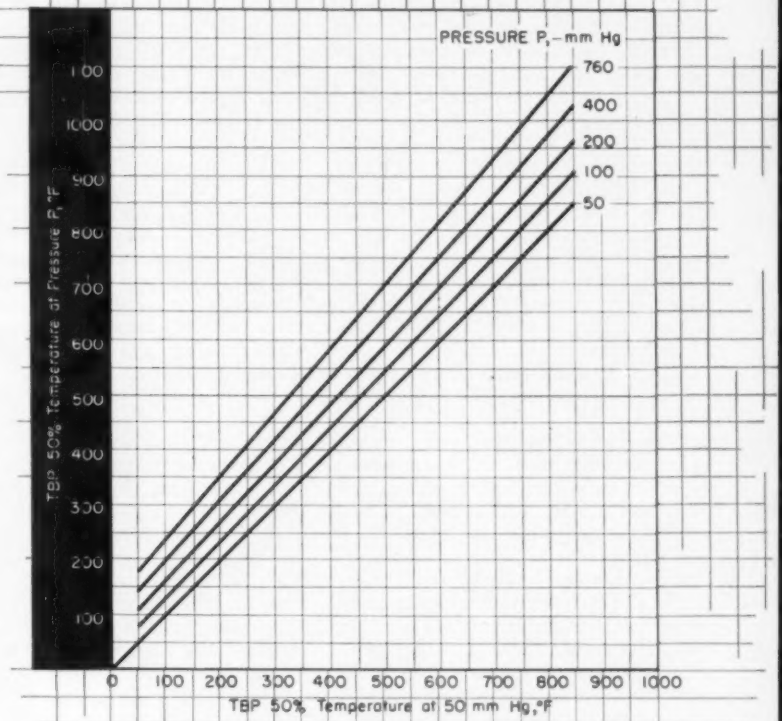

FIG. 5—TBP 50% Temperature for Subatmospheric Pressures vs. TBP 50% Temperature at 50 mm. Hg

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How Esso Standard Uses

Remote Automatic Tank Gaging

IF YOU are handling large volumes of liquid petroleum daily in storage tanks, it might pay to look into automatic instrumentation for liquid level gaging and temperature measurement.

Esso Standard Oil Co. investigated several methods and arrived at a decision which resulted in two installations which employ new electronic gages. One is at the Everett, Mass., refinery on four below-ground-level tanks, and the other is at the Paulsboro, N. J., marketing terminal on 17 storage tanks—both cone and floating roof type. Both installations show promise of fulfilling the anticipated advantages to automatic measurement

Manpower savings is probably the foremost advantage, as it is with all automatic gages. One man can obtain level and temperature readings on all 17 tanks at Paulsboro inside a half-hour. Before the installation, it took him 35 to 45 minutes on each tank to hand gage and get an average temperature, for a total of over 7½ hrs. for all the tanks.

In addition to this, Esso says there are four other important factors:

1—Increased accuracy. This of course is an obvious goal with all measuring instrumentation.

2—Increased tank working capacity. A remote-reading installation offers more efficient control, which should reduce the possibility of tanks being run over or pumped too low during pumping and transfer operations. To avoid this danger, a reasonable margin of capacity is usually allowed in establishing a "top working level" for tanks which are measured by hand gaging. The margin can become usable tank capacity when automatic gages are employed, since the chance for run-over is less likely than with hand gaging.

3—Evaporation loss from tanks in crude and volatile products service is minimized when automatic gages make it unnecessary to open tank hatches for hand gaging. It is admitted, of course, that the reduction of vaporization loss by this means is most important in cone roof tanks.

4—Accident reduction: when automatic gages are employed, the danger incurred by personnel climbing the tanks is reduced as the frequency of climbing the tanks is decreased. Lessened necessity for hand gagers making their way from tank to tank also is regarded an obvious contribution to greater safety. As possible hazards to personnel are cut down in number, the accident frequency can naturally be expected to decrease correspondingly.

Pro and con arguments vary with the type of tank installation for which any automatic gaging may be under consideration. Gilbert & Barker Mfg. Co., which instruments are used in the Esso installations at Paulsboro and Everett, explain some of these:

"It is probably true that the economic justification for installation of automatic gaging equipment varies in relation to the size and number of tanks in any given location. For example, in a small bulk plant using comparatively small tanks, the cost of automatic gaging equipment, in relation to the total investment, is relatively large. This figure must be balanced against the daily throughput and the possible saving. Here the economic justification must be decided from a long range point of view.

"The same thing is true at a plant where there may be larger tanks, but only a relatively small number of them, and where the savings in labor may not appear to offer economic justification for the cost of automatic gaging equipment.

"Such a long view is usually not necessary in refinery, pipe line, or large bulk plant installations. In the former two cases particularly, the cost of gaging equipment is a small percentage of total investment. And the increased inventory control and reduced stock loss resulting from extremely accurate gaging may be expected to be large indeed. Likewise, the savings in man power will be correspondingly large because of the size of the operation.

"It is true that inventory control techniques and stock loss control methods vary. Even accounting procedures in a particular company may have a bearing upon the value which that company may place on extremely accurate, remotely read gages—in any given situation or location within that particular company's operations. One company may well find in a given set of circumstances an economic justification which another company may deem insufficient.

"But in every segment of the industry—in refining, in pipe line operation, and marketing—closer inventory control and reduction of stock loss by any feasible means are daily assuming even greater importance. Man power savings also are receiving even greater attention as over-all costs continue to mount. The contributions to these problems which extremely accurate automatic gaging equipment make thus are looming ever larger in the viewpoint—both immediate and long range—of refinery, pipe line and marketing management."

The equipment Esso installed at the two locations consists of remote reading, automatic, electronic level gages, developed and made by Gilbert & Barker Mfg. Co., combined with automatic, averaging type resistance temperature measuring equipment, the thermometer assembly made by Weston Electrical Instrument Co. Level accuracy is 1/16 in., plus or minus, and readings can be made to 1/32 in. Temperature limitation is 175° F.

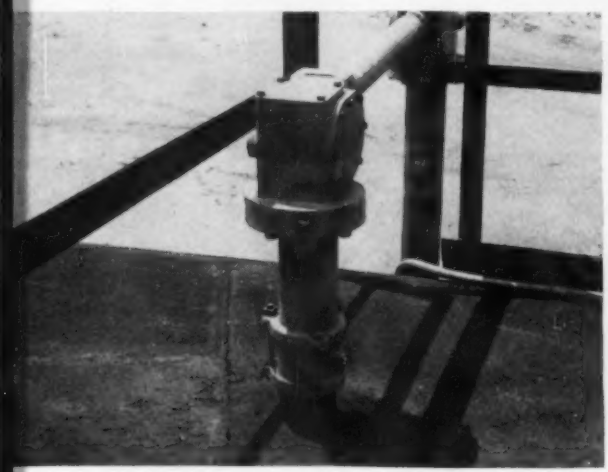
At the Everett Refinery, the installation is on four underground, concrete tanks, measuring 180 ft. long, 168 ft. wide, and 32 ft. deep.

One of the requirements was that no internal fixtures would be permitted in the tank. This facilitates removal of all instrument components while the tank is in service. The gaging equipment is mounted directly on the tank roof, and the standpipe (required with this type of equipment) extends upwardly approximately 10 ft. (See photographs.)

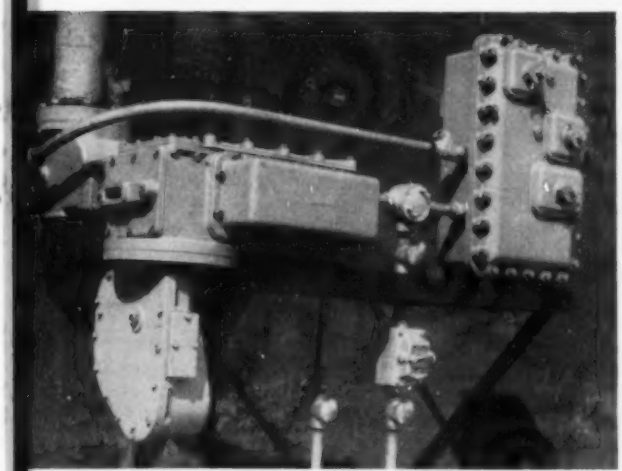
Remote indication of liquid level and temperature is used on this installation, and the receiver is located about 1600 ft. from the tanks. It is interesting to note that this particular location is a hazardous area, and the receiver, therefore, had to be explosion-proof.

The receiver is designed for remote gaging of 20 tanks, and has been equipped with audible and visual

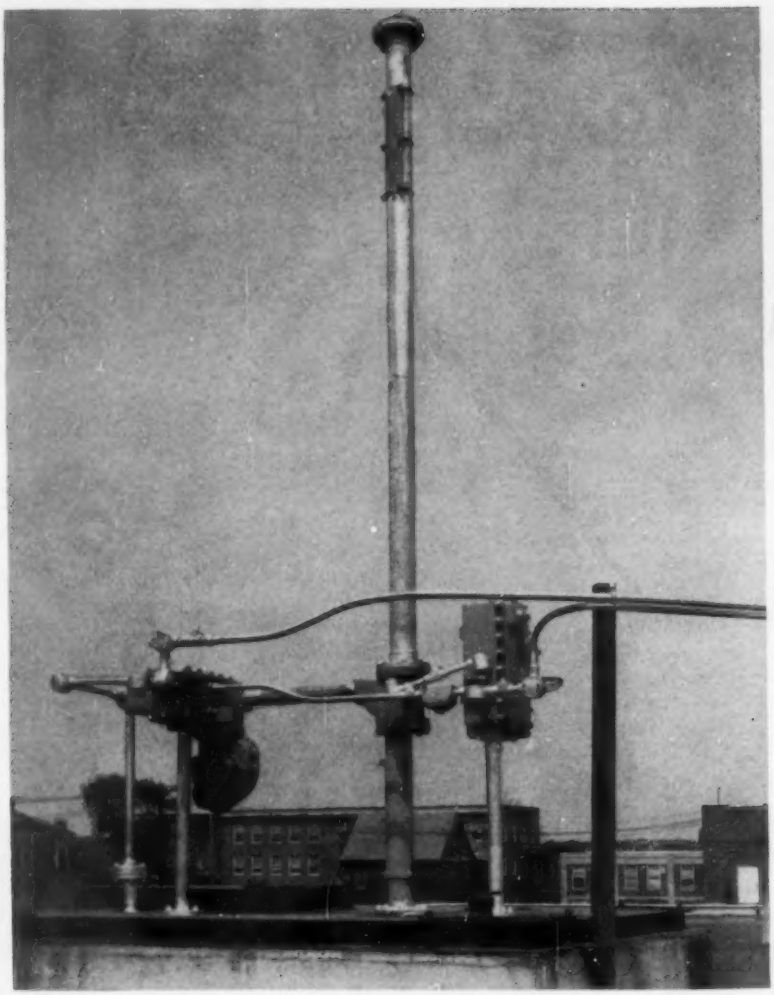
CENTRALLY-LOCATED RECEIVER at Paulsboro where operator takes readings on both liquid level and temperature



TOP OF CONE ROOF TANK, showing sheave box installation, containing the perforated tape and shielded electronic cable



EQUIPMENT AT BOTTOM OF TANK includes servo motor box with tape retriever (left), electronic control box (right)



DIFFERENT TYPE INSTALLATION is required on below-ground tanks at Everett refinery. Tape and electronic cable ride in elevated standpipe

SENSING ELEMENT, showing construction of protective cylinder around antenna

alarms, mounted at eye-level, to prevent run-overs.

These tanks are subject to conditions of extreme turbulence due to very rapid filling. Therefore a battery of switches is installed at the receiver which provides remote control for raising the sensing element to a high position in the tank until the liquid surging has been reduced to a practical limit.

A trick on this installation was the development of a workable means for retracting the RF cable controlling the sensing element while the tank was being filled. This was accomplished through the use of a multiple sheave arrangement in a 9-ft. standpipe above the gage pulley box.

No major changes in the tank design were required for the entire installation. The only alteration was in the mounting flange required on top of the inspection hatch. All connections between tanks and receiving instrument consist of electrical wiring in conduit.

At the Paulsboro terminal, the electronic gaging equipment is installed in 17 tanks. The tanks—of both cone roof and floating roof type—vary in diameter from 70 to 160 ft. and in height from 32 to 48 ft. Primary products are finished gasolines and light fuel oils.

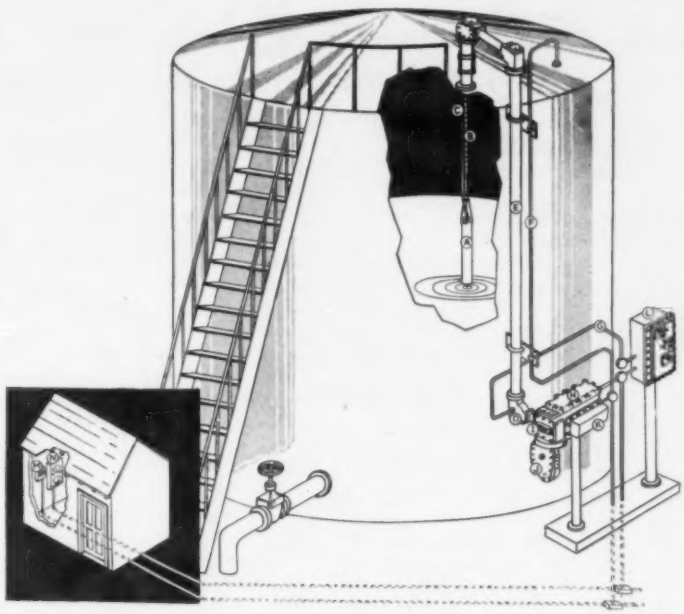
Product is received directly from tankers and is distributed from the storage tanks through a loading rack to trucks, and also to barges. The bottoms of the cone roof tanks slopes downward to the center and datum plates are located at both the side and the center. Water is drawn off before and after receipt of product.

The gaging receiver is located in a product testing laboratory approximately 1200 ft. from the farthest tank. Tanks are gaged daily at this terminal. The gager, working in the laboratory, can complete the job on all 17 tanks within a half-hour by merely turning a selector switch on the receiver to indicate liquid level and temperature.

As mentioned previously, this cuts down a daily operation from what used to take over 7½ hrs. to about a half-hour. The gager therefore is free to perform other duties as required.

No design changes were needed in the tanks nor any internal auxiliary equipment to permit installation of the gages. The only requirements were a 4-in. pipe nipple welded in the top of the tank and an angle iron support bracket on the outside at the base of the tank, plus a few brackets for supporting the 4-in. standpipe. Typical installations are shown in the photographs.

In the case of the floating roof



A—sensing element
B—perforated tape
C—shielded cable
D—pulley boxes
E—stand pipe
F—conduit for resistance thermometer leads
G—conduit for cable
H—servo motor box
I—mechanical counter
J—tape retriever box
K—automatic thermometer switch
L—electronic control box
M—remote temperature receiver
N—remote level receiver

THE GAGER WORKS MUCH LIKE a conventional float gage insofar as maintaining contact with the liquid, but there the resemblance ends (see text)

tanks, the gage sensing element assembly passes down through the roof inside an 8-in. standpipe, which also prevents rotation of the roof.

The way the level gage works is this: It consists of three essential units, plus pulley boxes and optional equipment. The three units are the sensing element, the electronic control, and the servo motor.

The sensing element is a hollow metal cylinder, 15 in. long and 2 in. I.D. From it, a straight wire antenna projects downward $1\frac{1}{16}$ in. below the open end of the cylinder. This antenna penetrates the liquid about $\frac{1}{16}$ in. The penetration is maintained electronically, and exactly, as the liquid in the tank rises or falls. There is no contact with the liquid other than the tip of this antenna. The entire element is not affected by splashing, surging, or accidental immersion.

The control is a simple, four-tube electronic circuit, using standard radio parts, connected to the sensing element by shielded radio-frequency cable.

The servo motor is the positive, power-driven unit of the gage. It raises or lowers the sensing element, as the electronic signals from the antenna dictate, by means of a perforated stainless steel tape which runs between the sensing element and a sprocket on the motor.

This high-torque motor overcomes the effect of varying friction in the sheaves or other mechanical components in the gaging system and is what makes possible the sustained accuracy of $\frac{1}{16}$ in., plus or minus. Gear-connected to the servo motor sprocket is a mechanical counter recording in inches and $\frac{1}{16}$ ins., with the fractions spaced widely enough to permit $\frac{1}{32}$ in. readings.

Indication can be at ground level or at top-of-tank; or for remote transmission—as at Esso—by means of potentiometers and gearing inside the motor box and connected to the remote-located receiver.

Principle of operation is this: minute radio frequency signals are carried to the antenna by the r.f. cable. A small one-tube transmitter (oscillator) in the electronic control box generates the signals. Simultaneously, return signals are carried back up the cable to a three-tube receiver-amplifier in the control box. A diode in the sensing elements allows this dual cable use.

Movement of liquid away from the antenna strengthens the return signal. Raising of liquid onto the antenna weakens the signal. This variation in the minute return signal, amplified in the receiving section of the control box so as to operate the servo motor, is the controlling medium.

The servo motor is a 2-phase, standard, 3450 rpm motor with built-in gear reduction of approximately 3500 to 1. One phase of the motor is connected to the amplifier, the other to the fixed line voltage. Since the amplifier voltage is a variable, the higher or lower voltage opposing the fixed voltage causes the servo motor to operate in either a clockwise or a counter-clockwise direction. This turns the sprocket which moves the perforated tape. Thus, the sensing element is raised or lowered in exact accordance with the liquid level.

Temperatures are obtained by means of an automatic switching device at the same time the level readings are obtained. This device selects the proper resistance bulb in an average resistance type liquid temperature unit mounted inside the tank. The switching device, cam-actuated with silver-plate points, is mounted on the servo motor box.

The remote-located receivers used with the gaging systems at Everett and Paulsboro are of the null-balance type. This means that variations in readings caused by transmitter loading are eliminated.

Receivers could be located as far away from the tanks as five miles. The scales are calibrated in feet, inches, and sixteenths, and are read simultaneously. Varying friction changes and temperature changes, normally affecting accuracy, are not present because the operation is by a servo motor, connected to the servo at the tank.

The selection system—for picking out on which tank a reading is to be taken—along with its indicating lights, is electrically separate from the measuring circuit. This prevents interaction and contributes to the accuracy.

Handcuff that Test Lab Thief

Improved accuracy in fractional analysis can put a stop to some sizable monetary losses

By D. P. THORNTON Jr.
Southwestern Editor

NATURAL gasoline manufacturers, through a cooperative program sponsored by the Natural Gasoline Association of America, are making progress in reducing the monetary losses that frequently occur in their plants as a result of even small inaccuracies in analyzing liquid hydrocarbon samples by low temperature fractional distillation.

The NGAA had established by earlier studies that the accuracy of analytical data involving the low boiling components of liquid hydrocarbons, usually propane, could be improved by various means. The equipment used in many company laboratories was found capable of higher analytical accuracy than was being attained in routine testing.

It was also found that the inaccurate data cost the oil companies much more than was generally believed.

For instance, the loss in sales of a 5¢/gal. gasoline could be nearly $500,000 in a year's time, if a natural gasoline plant design analysis was in error by 0.5 gal. of natural gasoline per 1000 cu. ft. of inlet gas on the basis of a 50,000 Mcfd plant. This was because the error prevented design production from being achieved.

Or, the plant loss could amount to $75,000 per year if a control analysis failed to detect 0.1 gal. of gasoline remaining in the residue gas due to inefficient operation in the plant.

Losses could happen, it was found, when errors occurred as low as 0.5 mol-% in analyses of any of the gas or product components in routine plant operations.

The NGAA program had its inception 15 years ago in a project to determine the types of apparatus and procedures used by members' laboratories in analyzing a field gas sample, and how closely the data from different laboratories checked. The results of this early work, hampered by World War II, made it evident that the average level of accuracy for low temperature analysis was below that for general analytical testing.

How far off some results were was not indicated in this early project, since it was not then possible to prepare a synthetic field gas sample. However, with this work as a starter, NGAA has been since trying to improve the situation. There has been growing cooperation from oil firms, natural gasoline plants, chemical companies, and commercial laboratories, all of which have the same problem.

In the latest test series, a total of 72 laboratories participated, representing 47 different companies.[1] They submitted 142 separate analyses of a synthetic sample of a liquid hydrocarbon.

Almost invariably "low" was the value reported for propane, the lowest boiling component present. This was continued evidence of a trend apparent since the beginning of the accuracy project.

The ten "best" laboratories missed the actual propane concentration—4.07 mol-%—by an average of 0.27 mol-%, although two of the group were in error by just 0.02 mol-%. Eight analyses out of the 142 were high: the two widest of the mark missed by 0.63 and 0.83 mol-% respectively. No analysis was "on the nose." All the rest were low, the worst by 2.77 mol-%, while the group average deviation from the known propane content was 0.81 mol-%.

This points up the conclusion of the NGAA fractional analysis project committee: The wide variety of low temperature fractional analysis equipment currently in use by oil industry laboratories is capable of more accurate determinations than the operators who use these facilities are able to secure in practice. That is, the errors for the most part are due to failure on the part of the operator, rather than inadequacy in equipment or fault in the method.

This conclusion is borne out by replies to questionnaires as to techniques used, design of equipment, corrections applied, methods of calibration and the like. The effect of these factors was studied by comparing data from a number of laboratories reporting the "best" results with a similar number reporting the "worst," or least accurate, findings.

The same variety in equipment design and other characteristics was found in both groups, thus proving that the equipment and techniques

Participants in the 1954 NGAA Fractional Analysis Program

17 Natural Gasoline Manufacturers

J. S. Abercombie Co.
Arkansas Fuel Oil Corp.
Arkansas-Louisiana Gas Co. (2 laboratories)
The Chicago Corp.
Cotton Valley Operators Committee
El Paso Natural Gas Co.
Hunt Oil Co.
Lone Star Gas Co.
Panoma Corp.
The Parade Co.
Sinclair Oil & Gas Co.
Sohio Petroleum Co.
Southwest Gas Producing Co., Inc.
The Superior Oil Co.
United Gas Pipe Line Co.
Warren Petroleum Corp. (2 laboratories)
Western Gulf Oil Co.

22 Oil Companies

Atlantic Refining Co. (3 laboratories)
Carter Oil Co. (2 laboratories)
Cities Service Oil Co.
Continental Oil Co.
General Petroleum Corp.
Globe Oil & Refining Co.
Gulf Oil Corp. (2 laboratories)
Gulf Research & Development Co.
Humble Oil & Refining Co. (2 laboratories)
Magnolia Petroleum Co.
Ohio Oil Co. (2 laboratories)
Phillips Petroleum Co. (4 laboratories)
Pure Oil Co.
Shell Oil Co. (3 laboratories)
Skelly Oil Co.
Standard Oil Co. of Calif.
Stanolind Oil & Gas Co.
Sun Oil Co. (2 laboratories)
Sunray Oil Corp. (2 laboratories)
The Texas Co. (4 laboratories)
Tide Water Associated Oil Co. (4 laboratories)
Union Oil Co. of California (2 laboratories)

8 Commercial Laboratories

Burrell Corp.
California Research Corp.
Chemical & Geological Laboratories, Inc.
Core Laboratories, Inc.
The Independent Laboratory
Podbielniak, Inc.
Southern Petroleum Laboratories
Wright Petroleum Laboratories

were capable of producing creditably accurate determinations, regardless of design and other variations. Replies to questionnaires in the latest project analysis bear this out.

This points the finger at the analyst as the principal source of error, through his failure to make corrections, to follow techniques accurately, or to his general attitude and morale. Some authorities[2, 3] also have included—with what merit remains to be seen—such factors as pay rates, prestige and the like.

Table 1 shows a breakdown of results reported by all 72 laboratories participating in the 1954 test series. An average of two analyses were made per laboratory (actually some made as many as four runs and several made three).

Of particular interest is the number of runs for each component in which the determinations are within 0.05 mol-% of the correct or synthesis value. In no case were 10% of the runs within this limit.

Within the limit of 0.1 mol-% of the correct value fall nearly 10% of the runs for most individual components. However, accurate determination of one component in a run was not followed through in accurately determining all the remaining components, in most cases. No laboratory made a correct determination for all components, though several hit two or three closely.

Table 1—Analytical Results from Laboratories Participating In Low Temperature Fractional Distillation Test Program

Analytical Result:	Component					
	Propane	i-Butane	n-Butane	i-Pentane	n-Pentane	Hexanes+
Number Correct	0	3	0	2	0	3
Number Above Correct Value	8	69	102	57	78	73
Number Below Correct Value	134	70	40	78	59	62
Deviation not exceeding:						
± 0.05 mol-%, Number	7	11	3	12	11	7
± 0.10 mol-%, Number	10	16	12	22	24	13
No. of Analyses Considered	142	142	142	137*	137*	138*
No. of Laboratories Represented	72	72	72	69*	69*	70*

* Two laboratories reported "C_5's-plus" and one lumped "C_5's." These data have been excluded in pentanes and hexanes-plus columns.

Table 2 summarizes the 10 "best" analyses reported. One of the laboratories listed was commercial, three were the "research" type and five were oil company plant control laboratories. Five have participated in the program from its inception, three had never participated previously, and two had run two of the previous samples.

The average deviation shown was computed by totaling, without regard to sign, the deviation from the known composition for each component and dividing by six. Previous deviations for each laboratory participating in earlier analyses of the series are listed.

Table 2 also lists the analysts' qualifications, tells whether the laboratory was represented at NGAA's fractional analysis school, and if the analyst attended the school. Of the six laboratories showing the smallest average deviation for the six components, only one had not participated in the NGAA school. Of the ten "best" laboratories, three did not participate and the status of one is unknown.

Group average deviations are not too informative, since there may be extremely wide variations in the analysis of one or more components by some laboratories which serve to compensate for one another. For example, the group average deviation for six components is only 0.87 mol-%. This actually masks the true situation, since individual laboratory deviations exceed even 1.5 mol-% in many instances.

Data for average deviations in the analysis of individual components,

Table 2—Summary of Ten "Best" Results

NGAA Liquid Sample No. 6

Component	Synthesis Value Mol-%	666 Run 2	658-A Run 3	636	618-A	625-B	658-B Run 1	631-B Run 2	693-B Run 1	686 Run 1	677 Run 1
Propane	4.07	3.83	4.05	3.92	4.06	3.52	3.88	3.76	3.9	3.73	3.89
Isobutane	13.05	13.05	13.24	13.15	12.63	13.05	13.25	13.48	12.9	13.14	13.65
N-Butane	30.80	30.95	30.83	30.70	31.02	30.79	31.16	30.99	31.0	31.10	30.52
Isopentane	11.08	11.03	11.24	11.28	10.99	11.37	10.72	10.91	10.9	11.37	11.19
N-Pentane	12.93	13.07	12.57	12.72	13.14	13.03	12.94	12.75	13.4	12.75	12.86
Hexanes+	28.07	28.07	28.07	28.23	28.16	28.24	28.05	28.11	27.9	27.91	27.89
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Avg. Deviation (6 Comp.)		0.097	0.127	0.153	0.173	0.187	0.190	0.220	0.223	0.227	0.237
Type Laboratory		Plant	Research	Research	Plant	Plant	Other	Plant	Research	—	Plant
Analyst attended NGAA School?		Yes	Yes	No	No	No	Yes	No	No	—	No
Laboratory represented at NGAA School?		Yes	Yes	Yes	No	Yes	Yes	Yes	No	—	No
Analyst's Education		2 Yr. Col.	B.S. Chem.	2 Yr. Col.	B.S. Physics	2 Yr. Col.	2 Yr. Col.	H. School	B.S. ChE.	—	M.S. Chem.
Analyst's Experience LTFD		14 Yr.	6 Yr.	10 Mo.	2½ Yr.	6 Mo.	1½ Yr.	2½ Yr.	1 Yr.	—	6 Yr.
Apparatus Used		Pod. Supercool	Hydrobot F. A.	CNGA Column	Pod. Heligrid	Pod. S. A.	Hydrobot Elec. Rec.	Pod. S. A.	Own Build	Fracton	Pod. High Cap.
Auxiliary Technique Used		—	V. P. Reanalysis	V. P. Reanalysis	—	—	—	—	—	—	—
Previous Deviations, mol-%:											
Liquid Sample #1		—	.94	.51	.48	.50	—	1.45	—	—	—
#2		—	1.14	2.58	.81	.61	—	.42	—	—	—
#3		—	.62	.25	.62	1.00	—	.25	—	—	—
#4		.35	.29	2.90	.14	.83	—	1.14	—	—	1.06
#5		.24	.45	1.97	.46	.54	—	.36	—	—	.70

■ More Accurate Analyses

while they also suffer from the above objection, are slightly more helpful in explaining the apparently low average deviation for the entire group of laboratories.

To cite a few examples, the group average for propane, present as 4.07 mol-%, was 0.81 mol-% below the true value, but the highest result reported is 4.9 and lowest, 1.3 mol-%.

Similarly, isobutane was present as 13.05 mol-% and the average was 0.33 mol-% too low, but the highest value reported was 15.05 and the lowest, 4.73 mol-%. Similarly, n-butane was present as 30.80 mol-% and analyses averaged 0.93 mol-% high; however, the highest result reported was 50.25 mol-% and the lowest 28.60 mol-%.

Improvement in testing is noted, the effect of better training of operators and of their participation in the NGAA school. The degree of betterment is not adequately reflected in the data from the latest NGAA cooperative testing program. This is because the most notable improvements were made by laboratories whose deviations in analyzing earlier samples were already low, while the previous high deviants in general did not greatly improve. The average deviation for laboratories participating in the school was 0.84 mol-%; non-participant deviation averaged 0.97 mol-%.

The systematic error regarded responsible for consistently low results on the lowest boiling component has not been corrected. It is still believed to be improper or inadequate correction for column hold-up. The unsatisfactory accuracy for the higher-boiling components is still attributed to the human element factors of skill, morale, attitude and training.

This was pointed up vividly in the report of the instructor at the NGAA school[4] which states:

"It has taken unremitting labor . . . to refresh the analysts in the obvious techniques, such as equipment calibration, leak detection, distillation rates, etc. The principal work of the school has been the correction of manipulating techniques. Time will not permit recounting all of the incorrect practices brought to my attention during my association with approximately 70 analysts."

The work at the school included the elimination of systematic errors, development of standardized calculation procedures and development of several experimental techniques to minimize errors. The school unfortunately had to be discontinued after nine months' operation, in which 84 analysts were trained, due to lack of further industry support. An outcome of this work, however, will be the preparation of a manual on low temperature fractional analysis.

The NGAA program has demonstrated that, too frequently, inaccurate analytical data costs the gasoline plants large sums of money. It has also shown that almost any improvement in accuracy usually will repay a sizeable proportion of the analyst's annual pay and perhaps a good portion of the cost of equipping and maintaining the plant laboratory.

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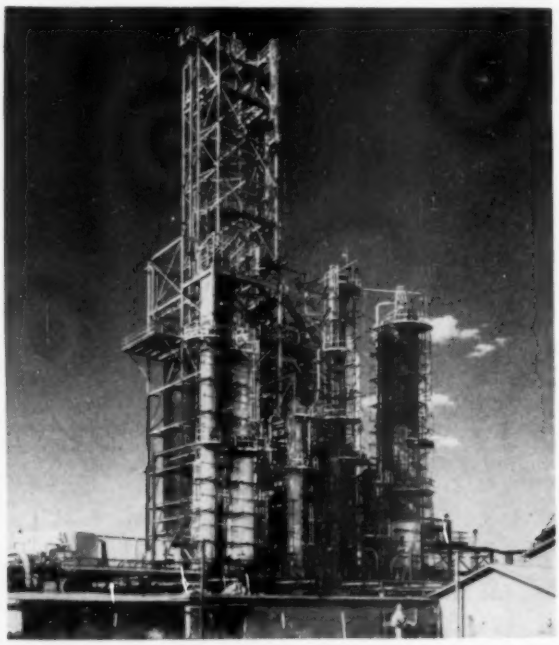
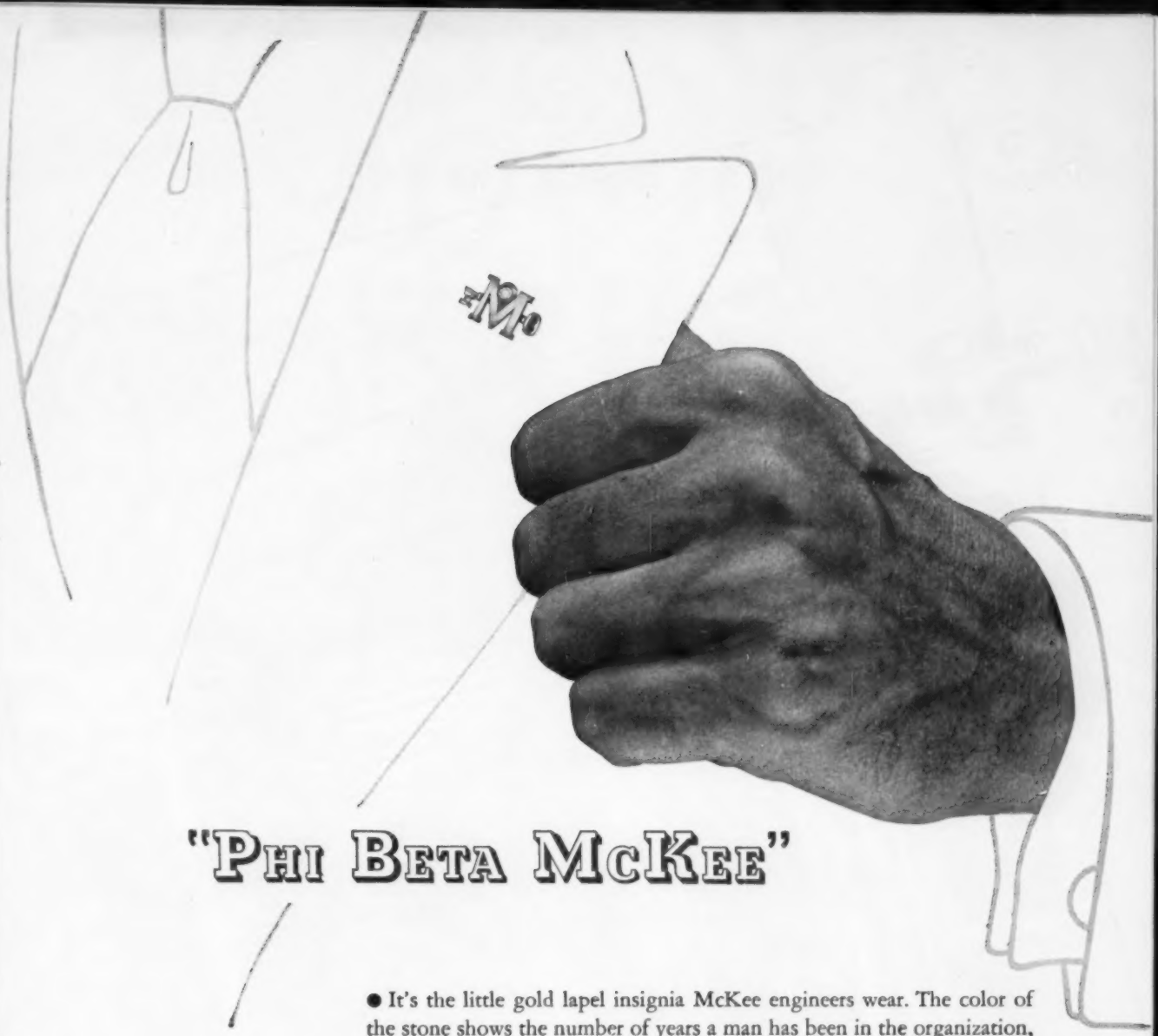
NEWS in VIEWS

PRACTICAL CHEMISTRY FOR SCHOOL CHILDREN—A model refinery kit, complete with process units, tanks, etc., has been made available to educators in seven western states, Hawaii, and Alaska by Standard Oil of California. Pupils assemble the pre-cut parts in classroom while studying the chemistry of petroleum processing.



NEW DELAYED COKING UNIT, of 9000 b/d capacity, now onstream at Duncan, Okla., refinery of Sunray Oil Corp., will produce 360 ton/day of raw petroleum coke to be marketed through Great Lakes Carbon Co. Unit will be operated by Sunray for Ucan Products Co., recently organized with Sunray holding 50% stock ownership.



"Phi Beta McKee"

● It's the little gold lapel insignia McKee engineers wear. The color of the stone shows the number of years a man has been in the organization, and a good many of them show twenty-five years and more.

Sure, we do a little kidding about them—call 'em our "Phi Beta McKee's"—but we wear them with pride. That's because they really mean years of ***experience,*** and in this highly specialized business of designing and building petroleum and chemical processing plants, experience pays off.

The design, engineering or construction of a modern refinery or chemical plant is a complex undertaking requiring the coordinated effort of many kinds of technical specialists and skilled craftsmen. Here at McKee we have it down to a smooth-working system because so many of us have been working together at it for so many years.

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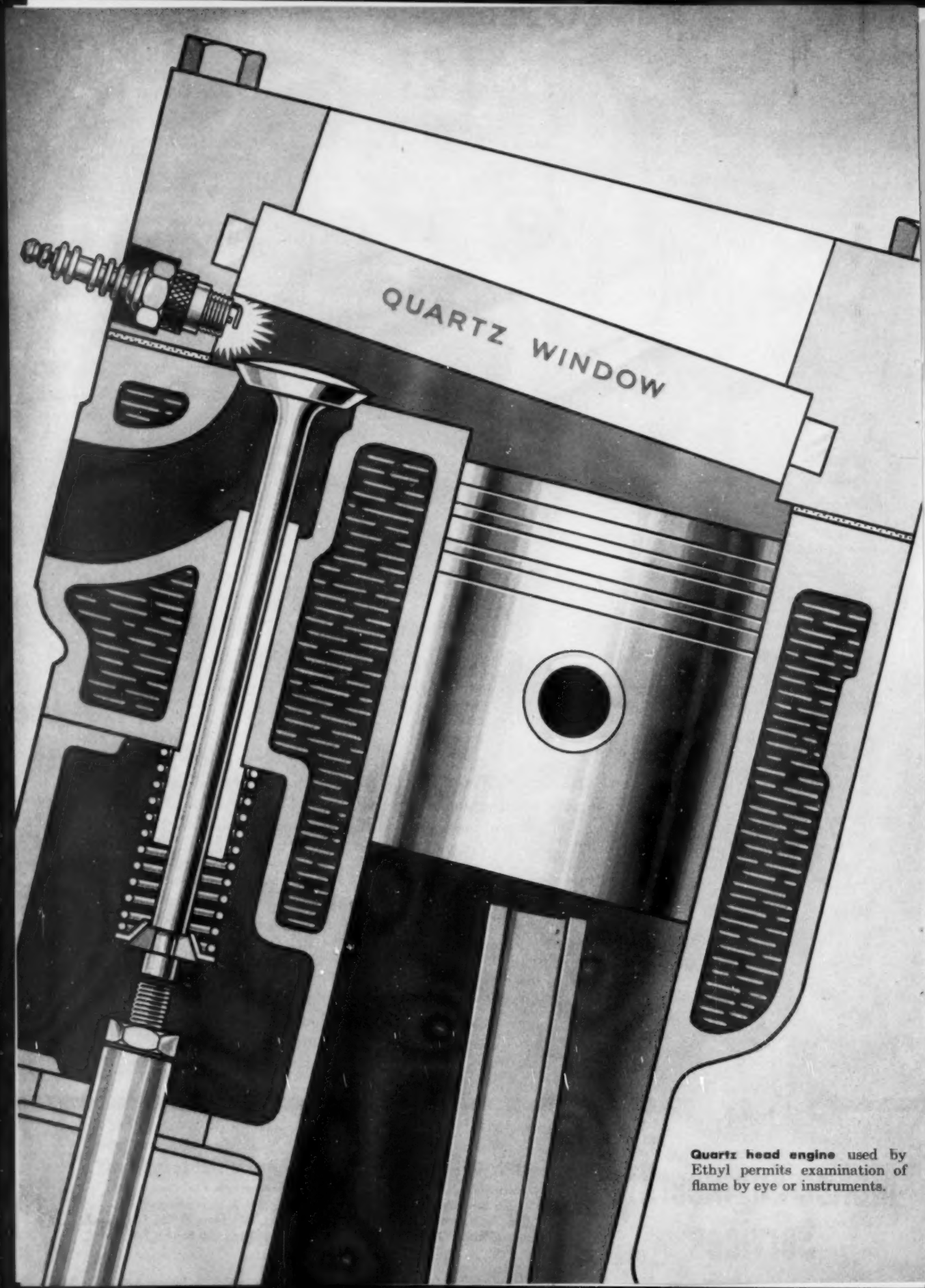


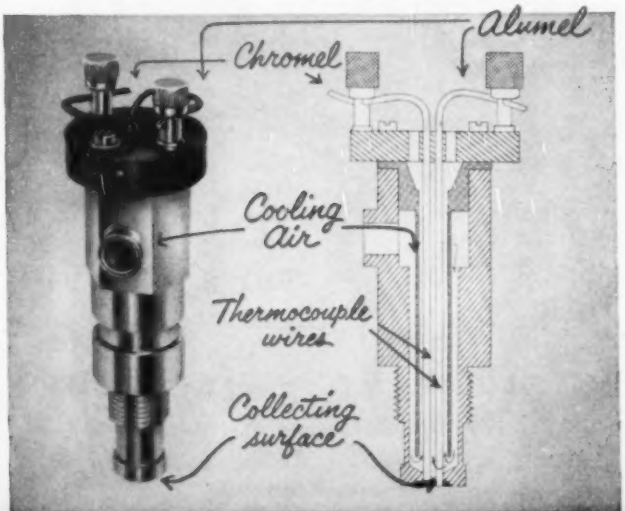
Quartz head engine used by Ethyl permits examination of flame by eye or instruments.

ETHYL RESEARCH TAKES A FLAME APART

to help tomorrow's engines run better

"Whirling pin cushion" designed by Ethyl people samples engine deposits as they are being formed.

Pressure indicator developed by Ethyl research accurately senses the rapidly changing pressures in the engine cylinder and sends the information to an oscilloscope for measurement.



Thermal plug mounted in combustion chamber provides a removable, temperature-controlled surface for collecting samples of combustion deposits.

LOCKED up in the mystery of how gasoline burns is a vital secret. It is known that dozens of chemical combinations are formed and broken down in the flame. But what are they?

It's hard enough to find out what goes on in a candle flame. But when you put the flame in the center of a block of cast iron and permit it to endure less than a thousandth of a second, the problem becomes even more difficult. And the difficulty is further increased since many important changes occur in the fuel as the fuel-air mixture is compressed by the piston before the flame begins.

Yet how much can be done to improve today's engines depends in no small measure on how much can be found out about this vital problem.

Ethyl research people have been working on the problem for many years in many different ways. Recently they have developed new test instrumentation and have used existing instrumentation in new ways, which show great promise in piecing together the answers.

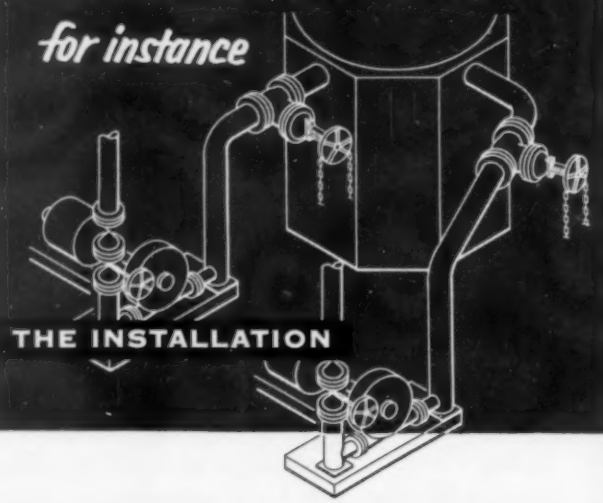
With the help of these new techniques we may all someday know considerably more about how gasoline burns. This will help refiners to make even more effective fuels, which will permit the production of more efficient engines than are practical today.

Ethyl continues its basic research into this vital question.

ETHYL CORPORATION
Research Laboratories
1600 West Eight Mile Road, Ferndale 20, Michigan
2600 Cajon Road, San Bernardino, California

You're Sure of Tighter Seating with Crane Steel Gates

...in a Butadiene Plant, for instance



THE INSTALLATION

At a Southwestern butadiene plant, using Crane 18-inch steel gate valves on suction lines from extractive distillation towers to pumps. Working pressure, 90 psi, 250 to 300 deg. F.

VALVE SERVICE RATINGS

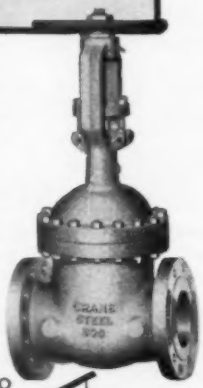
SUITABILITY:	Have what the job takes
FEATURES:	Epelloy seating
MAINTENANCE COST:	Zero
SERVICE LIFE:	Installed 1951-long life ahead
OPERATING RESULT:	Valve efficiency restored
AVAILABILITY:	Catalog item—No. 33X

THE CASE HISTORY

Original valves in this service were lubricated plug valves, but they couldn't be made to seat tightly on the light hydro-carbons and furfural mixture. Their continual leakage burdened the plant with excessive maintenance, and a constant threat to process control. All these lubricated plug valves were replaced with Crane 33X steel wedge gate valves.

Installed more than 2 years ago, the Crane valves completely remedied the leakage trouble, and to date, none have required any maintenance whatsoever. They keep working perfectly with but prescribed routine care.

THE VALVE



Product of pioneer skill in steel casting, and with a long record of service to petroleum and petrochemical industries, Crane steel valves stand apart from the ordinary. Yet they actually cost less for service delivered. Choose from the widest range of body and trim materials; in all pressure classes, sizes; flanged, screwed, or welding ends. See your Crane Catalog.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

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PETROLEUM PROCESSING

NOVEMBER 1954

Petrochemical Processing Section

IN THIS SECTION

Pesticides from Oil

The chemistry of the weed killers, the plant disease remedies, and 'bug' killers

—p. 1755

Know These Words?

Information for you on two terms in petrochemicals — polyvinylpyrrolidone and di-tert-butyl-para-cresol

—p. 1758

Ol' Mississipp' . . .

Eases the water problem at acrylonitrile plant—p. 1759

In the Departments

Acetylene and ethylene yields from lean stocks are good using this new process—(Patents) p. 1767

New, compact semi-pilot plant unit with wide flexibility of operation may fit your needs—(What's New) p. 1785

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Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

Published by The Pfaudler Co., Rochester, N. Y.

Both of these glassed steel discs were exposed to buffered caustic soda (pH 11.5) at 212°F. for 30 days. Acid-alkali-resistant glass (above) was unaffected.

Above, note how the high-quality glass which was formerly used in Pfaudler glassed steel vessels was severely etched.

Pfaudler Acid-alkali-resistant Glass Now Standard on Glassed Steel Units for Severe Chemical Service

On September 1, 1954, acid-alkali-resistant glass became standard for all Pfaudler glassed steel equipment for severe chemical service. This new glass was first introduced to the chemical industries in November, 1951, and has been available as "special" since then.

Almost universal corrosion resistance

Wide and varied field experience over the past three years fully verified the original expectations for this glass—it has acid resistance equal to or better than the previous standard glass and, in addition, it is *three times as resistant* to corrosion by alkaline solutions.

Specifically, this glass is resistant to corrosion by all acids (except hydrofluoric), even at elevated temperatures and pressures, and to alkaline solutions up to pH 12 and 212°F.

10% price reduction

As "special," acid-alkali-resistant glass carried a 10% premium charge over the former standard glass. Now as a standard, this premium is eliminated and it will be available at no increase in price.

Acid-alkali-resistant glass, like the former standard, is deep blue in color. To permit identification, there is a glass number on the name plate of every Pfaudler vessel. At present, the number "53" is being used to designate the new standard glass while the number "42" designates the former standard. A new numbering system for easier identification is now in process. Full details will be included in a later issue of "Corrosioneering News."

Field experience "proves in" acid-alkali-resistant glass

A 1,000-gallon oxidation kettle, lined with acid-alkali-resistant glass, was placed in use 3½ years ago, processing sodium hypochlorite bleach containing 12-15% free chlorine. It produced 3,694 batches before showing noticeable wear. This is more than three times as many batches as were possible with regular high-grade Pfaudler glass.

"WORKHORSE"

Heat Exchanger Solves Cleaning, Gasket Problems

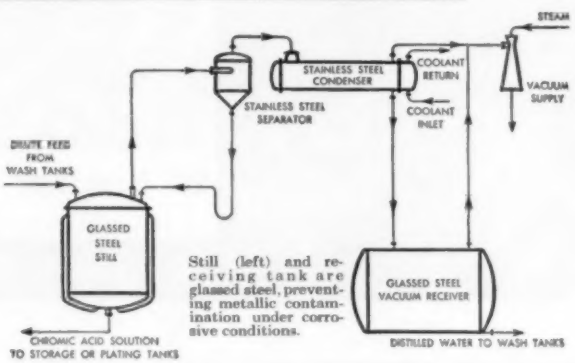
The nonremovable tube bundle of Pfaudler's Type FTS (fixed tube sheet) heat exchanger has won friends throughout the chemical processing industries. A money-saver, it simplifies cleaning and eliminates gasket problems.

The shell is permanently welded to the tube sheets, doing away with *all* gaskets or packed joints on shell side. There are *no* internal gaskets—no possibility of leakage or intermixture of hot and cold fluids.

Low First Cost

Original cost of Type FTS heat exchanger is low, because of its simple construction and standard design. Upkeep is low, because tubes are easy to clean, and you eliminate the problem of replacing gaskets or purchasing costly special gasket materials.

For complete data on this cost-cutting "workhorse," write for Bulletin 837.



Still (left) and receiving tank are glassed steel, preventing metallic contamination under corrosive conditions.

Packaged system recovers chromic acid

In plating operations, you can get substantial savings by the recovery of chromic acid from waste rinse water.

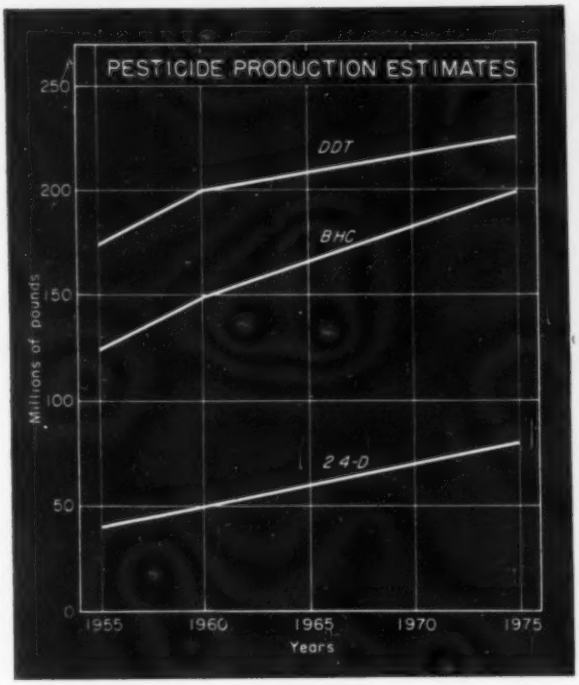
You do this easily with a Pfaudler chromic acid recovery system—a standard "packaged" system designed and fabricated by Pfaudler process engineers.

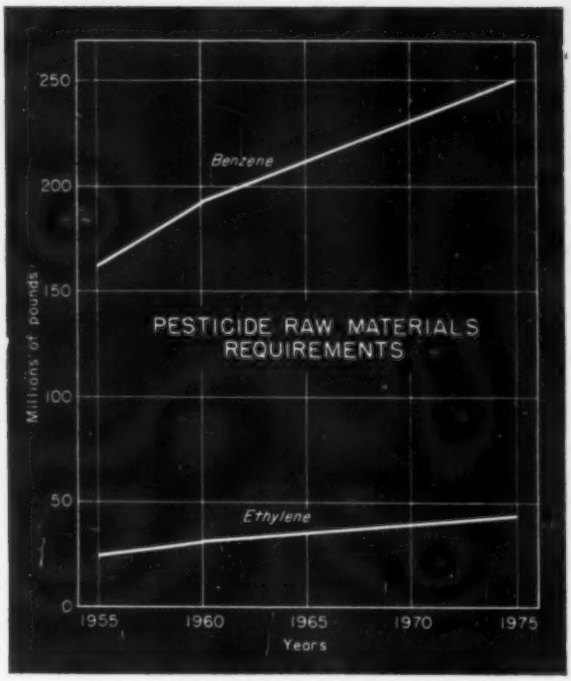
The system simply evaporates some of the waste wash water returning the balance to plating strength. This is then piped back to the plating tank. The distilled water obtained by the evaporation process is reused as pure wash water.

The Pfaudler system makes use of stainless steel for contact with pure water, while glassed steel protects equipment which must resist direct attack by the hot 24% to 45% chromic acid solution. Field experience and laboratory tests have both proven conclusively that acid-resistant glassed steel is the only practical material to withstand this attack.

Standard chromic acid recovery systems are available in capacities of 200, 300, 500 and 1,000 gallons. Often these systems pay for themselves within six months. One midwestern plant saved $42,000 a year by installing a Pfaudler system.

Write for Bulletin 914, which describes these systems in detail.





Pesticides from Petroleum

By MARSHALL SITTIG
Ethyl Corp. New York City

THE petroleum industry is playing an increasingly important part in the lives of the farmer and gardener. Aside from the growing application of mechanization to agriculture, with its demands for petroleum fuels, petroleum and petrochemicals are doing more and more every day to help to feed the world.

Take corn for example. Herbicides (weed killers) give the plants room to grow and eliminate weed pests which consume needed water and harbor harmful insects. Fungicides protect the seeds and young plants from disease. Insecticides allow the plants to produce higher yields. Petrochemical soil conditioners soften up the soil for better moisture penetration. Fertilizers from petroleum stimulate plant growth.

The first three of these materials—herbicides, fungicides, and insecticides — collectively are known as pesticides. It is this particular group of agricultural chemicals which this article covers.

Almost a hundred years ago, kerosene-soap emulsions were used for the control of fruit insects. Application of specific petroleum fractions as controls for insect and weed pests has expanded without injury to the desired crops in the area of application. Also, petroleum solvents are used as spray vehicles for a wide variety of chemicals. These uses have grown to the point where an estimated 75,000,000 gal./yr. of petroleum find use as pesticides themselves or as solvents for other organic pesticides.

Now, of even greater importance, we have petroleum as the raw material for many chemicals of use in agricultural pest control. These include benzene, xylene, petroleum sulfonates, naphthenic acids, cresylic acids and elemental sulfur. It has been estimated that the pesticide industry is currently producing about 1,000,000,000 lbs. of chemicals annually. Of this total, sulfur represents about 500,000,000 lbs. and all chlorinated insecticides about 300,000,000 lbs. About 200,000,000 lbs. of sulfur are used annually as an ingredient of dusts applied to cotton for the control of red spider mites. Other sulfur-containing mixtures are used as insecticides and fungicides on field crops and in greenhouses.

The requirement of benzene for the manufacture of all chlorinated organic insecticides has been estimated at 20,000,000 gal. (1952) to 250,000,000 gal. (1953). This is about 10% of total U. S. benzene production. In this connection the Paley report stated that the most important consumers of petrochemicals were the insecticides, DDT and benzene hexachloride and 2,4-D weed killer.* Their estimates of production of these commodities and the petrochemical requirements for their manufacture are summarized in the above charts and in Table 1.

Petroleum Products as Pesticides

Petroleum products themselves may be used as insecticides or herbicides. As a generalization, paraffinic hydrocarbons are the most effective as insecticides and aromatics are most effective as herbicides or weed killers.

Paraffinic hydrocarbons have been used as dormant sprays and as summer sprays for fruit trees.

* Report to the President by the President's Materials Policy Commission, W. S. Paley—Chairman, June, 1952.

Table 1—Petrochemical Requirements for Pesticide

(millions of pounds)

Year	Production Estimates DDT	BHC	2,4-D	Raw Materials Requirements Benzene	Ethylene
1955	125	175	40	162	25
1960	150	200	50	194	31
1975	200	225	80	251	44

Petroleum fractions have long been used as herbicides and, indeed, are playing a greater part than ever in modern weed control. Broad refinery cuts are used as contact, non-selective herbicides by railroads on roadbeds and sidings. Special cuts exhibiting high toxicity to plants are used as aquatic herbicides on canal and ditch banks and for control of weeds in irrigation systems. Certain fractions have also been used for the selective control of weeds in cotton. Fuel oil and No. 1 Diesel oil are widely used as carriers for 2,4-D and 2,4,5-T esters in airplane application on cereal grains and for mesquite control in the Southwest.

Petrochemicals for Pesticide Manufacture

Many petrochemicals serve in the role of agricultural chemicals. These include insecticides, fungicides, plant growth regulants (the most important currently being the hormone-type weed killers) and fertilizers.

Insecticides

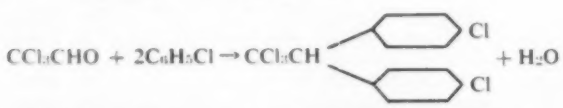
Let us first examine the synthesis of a number of important insecticides to see how petroleum-based raw materials can enter into their manufacture.

One class of insecticides is soil fumigants. Land which is infested with nematodes, wireworms or other destructive pests may be brought into profitable production by the use of those materials which include ethylene dibromide, methyl bromide, D-D mixture (mixture of 1,2-dichloropropane and 1,3-dichloropropene).

DDT and Its Analogues: DDT, its related olefin and its methoxy derivatives are all important insecticides which can be synthesized from petroleum benzene. The formulas of these materials are:

$(p\text{-}ClC_6H_4)_2CHCCl_3$ (DDT)
$(p\text{-}ClC_6H_4)_2C=CCl_2$ (DDD or TDE)
$(p\text{-}CH_3OC_6H_4)_2CHCCl_3$ (Methoxychlor)

DDT is manufactured by the condensation of chloral with chlorobenzene in the presence of 100% H_2SO_4 or oleum according to the equation:



The chloral is prepared by the chlorination of ethanol.

Methoxychlor is prepared by a process similar to that used to manufacture DDT, except that the starting materials are chloral and anisole (phenylmethyl ether).

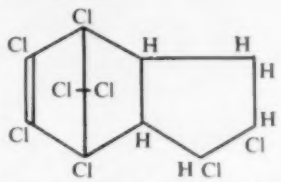
The third member of this group, 1,1-dichloro-2,2-bis (*p*-chlorophenyl) ethane is known as TDE (or DDD) and is prepared from dichloroacetaldehyde and cholorobenzene. It occurs as a by-product in DDT manufacture also, since dichloroacetaldehyde occurs as an impurity in chloral.

Benzene Hexachloride: The compound, 1,2,3,4,5,6-hexachlorocyclohexane bears the common name benzene hexachloride. It is prepared by the direct chlorination of benzene in the presence of light and consists of a mixture of stereoisomers. Only one of these stereoismers, the gamma isomer (which is present to the extent of about 15% in so-called "technical" BHC) has any appreciable insecticidal activity.

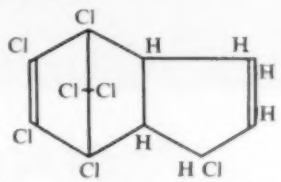
Multi-stage solvent extraction results in a product containing 99% of the gamma isomer, which is then designated as lindane. The so-called "waste" isomers from this extraction process are thermally cracked to produce trichlorobenzene as a further chemical raw material.

Polycyclic Insecticides: Several polychlorinated polycyclics are of importance. These include:

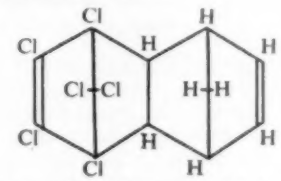
1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene; or chlordane:



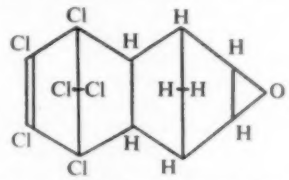
1,4,5,6,7,8,8-heptachloro-3a,4,6,6a-tetrahydro-4,7-methanoindene; or heptachlor:



1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene; or aldrin:



1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethanonaphthalene; or dieldrin:



Chlordane is prepared by subjecting hexachlorocyclopentadiene and cyclopentadiene to a Diels-Alder reaction, followed by chlorination of the first product. Heptachlor is produced by a similar process.

Aldrin and dieldrin are also prepared by the Diels-Alder condensation as indicated by the fact that their names have been derived from the names of the German inventors of this famous reaction. It is believed that aldrin is prepared by the following steps:

1—Diels-Alder condensation of perchlorocyclopentadiene with acetylene.

2—Condensation of the product of (1) with cyclopentadiene to give aldrin.

Dieldrin is presumably prepared by a similar process with epoxy-cyclopentadiene being used in the second step.

Parathion: This is the commonly-used name for 0,0-diethyl O-*p*-nitrophenyl thiophosphate which may be prepared by the following steps:

$$PCl_3 + S \rightarrow PSCl_3$$
$$PSCl_3 + 2\ C_2H_5ONa \rightarrow (C_2H_5O)_2P(=S)Cl + 2NaCl$$
$$(C_2H_5O)_2P(=S)Cl + NaO\text{-}C_6H_4NO_2 \rightarrow (C_2H_5O)_2P(=S)OC_6H_4NO_2 + NaCl$$

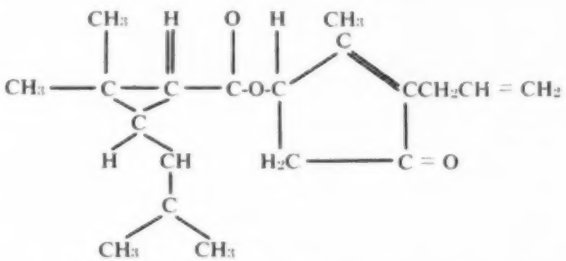
The sulfur used can be recovered from "sour" gases. Petroleum benzene can be utilized and the ethanol used in the preparation of the sodium ethoxide can be made by the hydration of ethylene.

Tetraethyl Pyrophosphate (TEPP): This material first found application as an insecticide in Germany in World War II and may be prepared from triethyl phosphate by the following reactions:

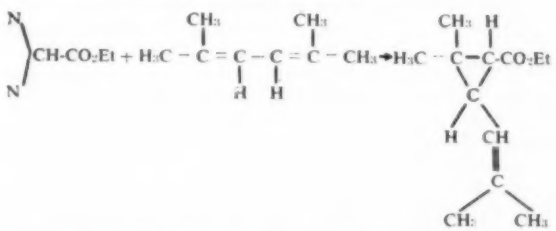
$$3\ (C_2H_5)_3PO_4 + POCl_3 \rightarrow (C_2H_5)_6P_4O_{13} + 3\ C_2H_5Cl$$
$$5\ (C_2H_5)_3PO_4 + POCl_3 \rightarrow 3(C_2H_5)_4P_2O_7 + 3\ C_2H_5Cl$$

The products of both reactions are mixtures of ethyl polyphosphates. The product of the first reaction is hexaethyl tetraphosphate which may contain 8 to 20% of TEPP. The product of the second reaction is technical TEPP, which may contain up to 40% of pure TEPP having the structural formula:

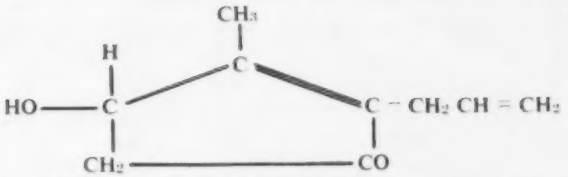
Allethrin: The dl-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of a mixture of cis-and trans-dl-chrysanthemum carboxylic acid has been given the common name of allethrin. This material is of particular interest in that it represents the synthesis of a compound resembling the natural pyrethrins and cinerins, the toxic materials in pyrethrum flowers and some of the oldest natural insecticides known. Allethrin has the structural formula:



The initial step in the reaction involves condensation of ethyl diazoacetate with dimethylhexadiene to give chrysanthemum monocarboxylic acid ethyl ester:



Then pyruvaldehyde and the sodium salt of 3-oxo-6-heptenoic acid are condensed and a ring-closure reaction is effected to yield the following alcohol:



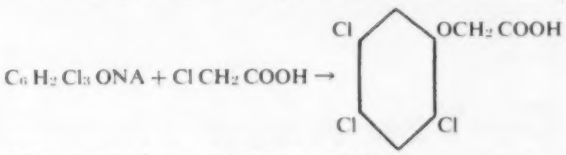
This alcohol is then esterfied with the chrysanthemum acid to give synthetic allethrin.

Petrochemicals can enter this synthesis in a number of ways. Petroleum-derived ethanol can be used in the manufacture of the ethyl diazoacetate. Then petrochemical acetylene and petrochemical acetone combine to give dimethylhexynediol which is hydrogenated and dehydrated to give the hexadiene. The 3-oxo-heptenoic acid uses allyl chloride (from propylene chlorination) as a starter.

Herbicides

As mentioned above under benzene hexachloride, the manufacture of lindane provides a large quantity of "waste" isomers as a petrochemical raw material. These isomers are thermally cracked to trichlorobenzene and may then be processed to 2,4,5-T weed and brush killer:

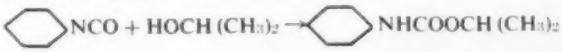
$$C_6H_3Cl_3 + \tfrac{1}{2}\ Cl_2 \rightarrow C_6H_2Cl_4 + HCl$$
$$C_6H_2Cl_4 + 2NaOH \rightarrow C_6H_2Cl_3ONa + NaCl + H_2O$$



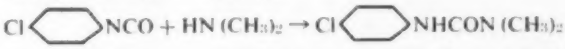
This product is the 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid which may, for ease of application, be converted into more soluble esters such as the butoxy ethoxy propanol (or BEP) ester.

The action of 2,4,5-T is restricted to broad-leaved plants and to woody plants, and it is designated as a selective herbicide. Similarly 2,4-D (2,4-Dichlorophenoxyacetic acid, made by reactions similar to the above, starting with dichlorophenol) is a selective killer of broad-leaved plants.

A selective herbicide whose action is restricted to narrow-leaved plants, or grasses, is IPC which is made by the following reaction, using isopropanol from propylene and phenyl isocyanate from benzene:



A non-selective herbicide, or soil sterilant, which kills both broad-leaved and narrow-leaved plants is CMU, made from *p*-chlorophenyl isocyanate from petroleum and dimethylamine by the reaction:



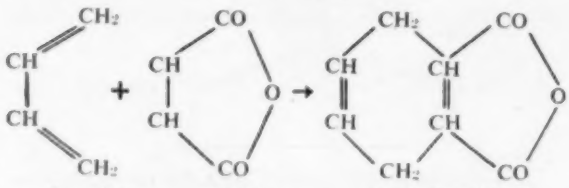
It is of interest to note that petroleum cracking catalysts are useful in herbicide application. Adsorptive clays are used as carriers for pelleted herbicides—the granular pellets having advantages for certain applications.

Fungicides

Among the organic fungicides in wide use today are the carbamates. One example is ethylenebisdithiocarbamate: $NH_2\text{-}CS_2\text{-}C_2H_4\text{-}CS_2\text{-}NH_2$, which can be prepared from ethylene dichloride and dithiocarbamic acid.

Another fungicide of high current interest is captan (formerly SR-406) which is N-trichloromethylthio-tetrahydrophthalimide. This compound is derived from petro-

leum raw materials in the following manner:



Butadiene — Maleic Anhydride — Tetrahydrophthalic Anhydride

The tetrahydrophthalic anhydride is then converted to captan.

Petrochemicals for Pesticide Formulations

Insecticides, herbicides and the like may be made into solutions, emulsions and aerosols with the aid of petroleum-derived solvents, emulsifiers and propelling agents.

Where petroleum products are used as solvents and carriers for pesticides, their action is occasionally a multi-purpose affair. Thus, an action may occur whereby the combination of pesticide and solvent is appreciably more potent than the sum of their individual actions. The petroleum solvent may act as a sticking agent to promote adherence of the pesticide to the crop being treated, prolonging the residual effect of the formulation.

As a general rule, the pest control chemicals described in the preceding section cannot be effectively applied in full strength and thus require dilution for effective spray applications. Also, the physical form of the 100% materials may be unsuited for direct application, in that they may be too viscous, or waxy.

Petroleum solvents for the chlorinated insecticides, such as DDT and lindane, are commonly aromatic fractions, often supplemented by small amounts of more expensive but powerful cosolvents. Aliphatic fractions exhibit very low solubilities, necessitating the use of materials such as alkylated naphthalenes having higher solvent power. The cosolvent materials which may be used include such petrochemicals as isophorone, methyl ethyl ketone, and cyclohexanone.

In general, formulated insecticides take one of three general forms:

1—**Dusts,** which consist of low concentrations (2%, for example) of the active material in admixture with inert ingredients, such as clay or talc.

2—**Sprays** which may take the form of

a. Solutions of the active material in petroleum hydrocarbons or petroleum derivatives.

b. Emulsions of the active material in water. These are usually compounded from wettable powders (powdered insecticide plus emulsifier) or from emulsifiable concentrates (liquid mixtures of insecticide and emulsifier in oil).

3—**Aerosols** which may be applied as fogs by means of liquefied propellant gases (such as methyl chloride) or by the use of mechanical generators.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Di-tert-Butyl-para-Cresol

2, 6-di-*tert*-butyl-*para*-cresol, pronounced "dye-**tur**-shih-**ehr**-ih-**beu**-tihl-**pahr**-aah-**kree**-soul," is not an entirely new petroleum chemical, but it is one which is finding increasing use. It is a white, crystalline solid that is soluble to an appreciable extent in alcohols, mineral oils, and many other solvents, although it is insoluble in water. In the food industry, it is also known as butylated hydroxy toluene, and one trademark abbreviation is "dbpc."

This chemical was first developed as an antioxidant for gasolines, lubricating oils, and insulating oils, but has since been found effective also as an antioxidant in rubber, paraffin waxes, and fatty foods such as lard and shortening. It has also been recommended for use in industrial fats and oils, some insecticidal compositions, and in certain plastic materials.

This compound may be manufactured by the reaction of cresols ("cresylic acids," or fractions thereof) and isobutylene, followed by separation of the desired product. Both reactants are available as commercial petroleum derivatives, the cresols being extracted from cracked naphthas by treatment with dilute caustic soda, and isobutylene being recovered from refinery cracked gases or deliberately prepared by dehydrogenative cracking of isobutane.

Many antioxidants are now on the market; so it is impossible to assay the merits of any one of them without comparative data. Di-*tert*-butyl-*para*-cresol, however, merits at least some notice, because it is one petroleum chemical which has passed Food and Drug Administration requirements for use (in small quantities) in foods.

Polyvinylpyrrolidone

Polyvinylpyrrolidone, often abbreviated "PVP," is another petroleum-chemical derivative of acetylene and formaldehyde. Pronounced "**pahl**-ih-**vy**-nill-pih-**roll**-ih-dohn," it has the formula $[{}^{\bullet}CH_2{}^{\bullet}CH(C_4H_6NO)^{\bullet}]_n$, meaning that it is a polymer containing a vinyl-type chain, to every other carbon atom of which is attached a cyclic group containing nitrogen, carbon, hydrogen, and oxygen atoms. It is normally supplied as a white powder, obtained by spray-drying a solution of the polymer in water.

Indeed, this polymer is unique in that it is soluble in water and in a variety of common solvents, particularly alcohols. It has been widely publicized (and used in Germany) as an extender for blood plasma (i.e., as a blood-volume expander), and is also finding increasing application in uses ranging from hair lacquers and shaving creams to antibiotic preparations and detoxifying agents for tetanus and diphtheria serums.

PVP is produced from acetylene ($CH{\equiv}CH$) and formaldehyde ($HCHO$) by a lengthy series of reactions which include selective addition, then removal, of hydrogen; reaction with ammonia; and, finally, reaction of the resultant pyrrolidone with more acetylene to yield N-vinyl-2-pyrrolidone. This, in turn, is polymerized to yield PVP. Acetylene can be produced from natural gas or petroleum fractions, as also can formaldehyde, ammonia, and hydrogen. While production of PVP may at present be based on coal-derived quantities of some of these chemicals, it seems extremely likely that its future output will be derived from natural gas or petroleum products.

PVP is a chemical about which fascinating stories may be woven in the future—a future for which predictions are bright.

WATER IS NO PROBLEM for American Cyanamid's Fortier plant, with the whole Mississippi River at the front door. Shown here are the river pumping station, gravity settling basin, and chemical clarification unit

'Old Man River'—He Supplies Treating Water to Fortier

IN the design and construction of the Fortier petrochemical plant of the American Cyanamid Co., in Louisiana, special attention was given to the utilities. Since the volumes of water used are large, prevention of both water and atmospheric contamination is necessary and any interruption of power for the predominantly electric drives would be a serious matter.

Up to 15,000,000 gal. daily of water, all but the potable supplies, will be pumped from the Mississippi to the plant doorstep. All effluents will be treated before being returned to the river, to eliminate any possibility of contamination. Public water supply intakes are but a few miles downstream and close control of even runoff waters from certain plant areas is necessary. Moreover the surrounding community is largely agricultural.

One of the most important criteria governing the selection of the plant site was the availability of large volumes of water requiring a minimum of treatment. The location near Avondale, above New Orleans, on the Mississippi, was attractive because a flow was assured in quantities much larger than any demand the plant might make.

In addition, due to the topography of the river bed further downstream, the water is substantially free of significant increases in chloride content from tidal action, despite the fact that bottom is considerably below sea-level. The site chosen is protected from floods by a high levee but has ready access to facilities for shipping products either by rail or water.

The plant intake is located 3 ft. below sea-level and approximately 25 ft. below mean river level. The river bottom is more than 100 ft. below the intake elevation, however. Two electrically-driven centrifugal pumps are installed, capable of delivering approximately 20 million gal. daily total of raw river water. For initial operations the pumpage will range from 7-10,000,000 gallons daily at 45° to 90° F., winter and summer.

The influent is split into two streams of approximately equal volume, one for once-through water and the other for treated services. The once-through water is settled in a holding basin to drop out mud and thence to cooling services at the sulfuric acid, acetylene and ammonium sulfate units. This material is turbid and, once used, is returned to the river downstream of the intake without further treatment. Design flow through the basin is 3800 gpm.

The stream for treated services is

clarified, using ferrous sulfate or alum interchangeably with lime for coagulation. This water furnishes make-up to the plant's two cooling towers of 35,000 and 20,000 gpm. capacity, respectively, and the balance is further treated for boiler feedwater by the hot lime-zeolite process. A large feedwater make-up is required since approximately 50% of the steam produced is eventually consumed in processing.

All potable water is purchased from the public water system of Jefferson Parish (county). Provision has been made, however, for future installation of filtration and chlorination facilities should the plant need ever exceed available supplies from the public system.

The fire-fighting system, consisting of a fire-belt circuit and two elevated water tanks, is initially supplied from the process (clarified) water system and always is kept filled with this purified water to minimize corrosion and deposition of mud. However, should the pressure drop in this system during a fire, a diesel-driven emergency pump taking suction on the settled (raw) water basin can be manually started to restore the deficiency.

Since the plant has been laid out with expansion possibilities in mind, all lines and some pumps have been sized for approximately two and one-half times initial design requirement.

Effluent disposal is as important as the water supply itself and in general consists of four streams in addition to the once-through cooling water pumped back to the river without treatment. The four streams are:

1—Underflow water from coagulating and settling basins. Relatively small volume and pumped back without treatment.

2—Sanitary wastes. Passed through a comminutor to break up solids, then pumped to river without further treatment.

3—Normal rainwater run-off. First 20 minutes of rainfall in any process area is diverted to effluent treatment lagoon. Run-off from all other areas and process areas after 20 minutes is diverted to surface drainage ditches whence it drains into "back-country" swamps. Drainage away from the river is characteristic of this Delta country.

4—Process effluent. Collected in each unit and moved to effluent lagoon.

The effluent lagoon is more aptly described as an equalizing and aging pond. Dredged out near one end of the plant site, it has sufficient capacity for eight days of normal plant operation, plus a "margin" to take care of 20 minutes surface run-off from process units.

The pond is built with a central baffle reaching from one end nearly to the other. This provides a relatively long retention period, as effluent must traverse twice the length of the pond. Also, the withdrawal rate can be regulated for flexibility.

Streams from the various units enter a common chamber for thorough mixing before flowing to the next chamber. Here pH is adjusted with caustic to the range of 9.5 to 10. Going on around the pond, the effluent is withdrawn into holding tanks equipped with agitators where additional caustic is added as necessary for precise pH adjustment. Chlorine is added to a circulating slip-stream until a residual of 1 to 1.5 ppm. is obtained in the tank and then the effluent is held for two hours.

The second step repeats the first, after which the effluent is given a final chlorination if necessary. The treated effluent then joins and is mixed with the outgoing stream of once-through cooling water and passed to one of three pump stations which lift the effluent over the levee into the river. These stations handle different plant areas. All are equipped with spare pumps.

Frequent samples of effluents will be analyzed in accordance with Louisiana State recommendations and kept on record. The treatment provided for the effluents amply meets the state's requirements.

The steam system at Fortier consists of three primary outside-type boilers generating 200,000 lbs. each at 600 psig. and 750° F., plus three waste-heat boilers. Three turbine driven forced draft fans utilize the 600 psi. supply, exhausting at 150 psi. back-pressure. A pressure-reduction and desuperheating station by-passing the turbines is installed to provide additional 150 psi. steam if needed. If necessary, fans can be electrically-driven for heat balance.

The boilers are completely instrumented, with elaborate Bailey combustion controls to handle three separate fuel streams simultaneously. The fuel may be natural gas, mixed tail gas from the acetylene unit, or regenerated 400 Btu. gas from the ammonia plant. Residual gas from the HCN plant is piped in with the mixed tail gas from the acetylene plant.

Each boiler has four burners, and can use any one or a combination of the three fuels available. The ring section around the burner tile fires natural gas. Two concentrically-mounted guns in the center of the ring fire the other two fuels. A ratio-controller on each stream will control air on a pre-set Btu. basis established by analysis; this controller is reset by an oxygen analyzer on the flue gas. All burners are individually monitored by a "Fire Eye" detector.

The 150-lb. steam is used for steam drives on critical services and for steam-driven spare pumps and the like in the process area. Some of these exhaust to 45 psi. to provide the relatively small quantity of low-pressure stripping steam required in the plant. The major portion of the 150-lb. supply is used for process heating and stripping; this is not returned to the boiler house as condensate.

Electricity is purchased to save capital for other purposes and because the local utility record of uninterrupted service was excellent despite the area's reputation for frequent, violent electrical storms. Consumption for the initial plant is expected to range from 8 to 12,000 Kw.

Power is received at the Louisiana Power and Light sub-station at 110,000 v., where it is reduced to 18,800 v. for primary distribution, via two independent feeder lines. The automatic transfer switch here will shift the plant from the preferred feeder to the other in a time interval of 25 cycles (less than ½ sec.) with return as soon as trouble on the preferred circuit has cleared.

All plant distribution is underground to minimize interference from lightning. Unit sub-stations reduce the voltage to 4160 for motors of 125 Hp. and larger. A separate unit sub-station provides 440 v. current for smaller motors and 110 v. for lighting and control circuits. There are four feeders from the plant's entrance sub-station and each unit sub-station is supplied by either of two loops to minimize outage trouble and provide flexibility in balancing power. Automatic transfer switches are installed also.

Other plant utilities consist of the refrigeration, purge nitrogen and plant air systems. At present 3000 tons of ammonia refrigeration capacity are installed as a single unit. A 5000 Hp. Carrier centrifugal compressor is the heart of this unit, supplying ammonia at 225 psi. (suction pressure is 15 psi.). The direct ammonia lines supply the four process units and the air-conditioning load (office buildings, cafeteria and control rooms—laboratories) is handled via chilled water. In certain other plant areas, however, ammonia would be a serious process hazard and in these cases ammonia is used to chill brine or some other suitable intermediate.

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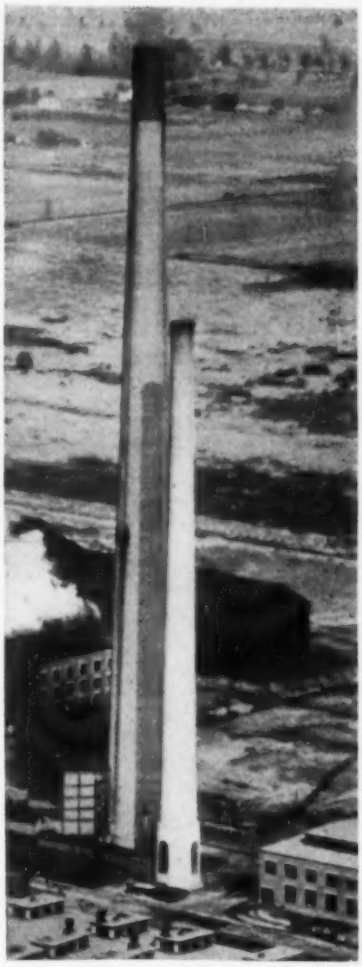

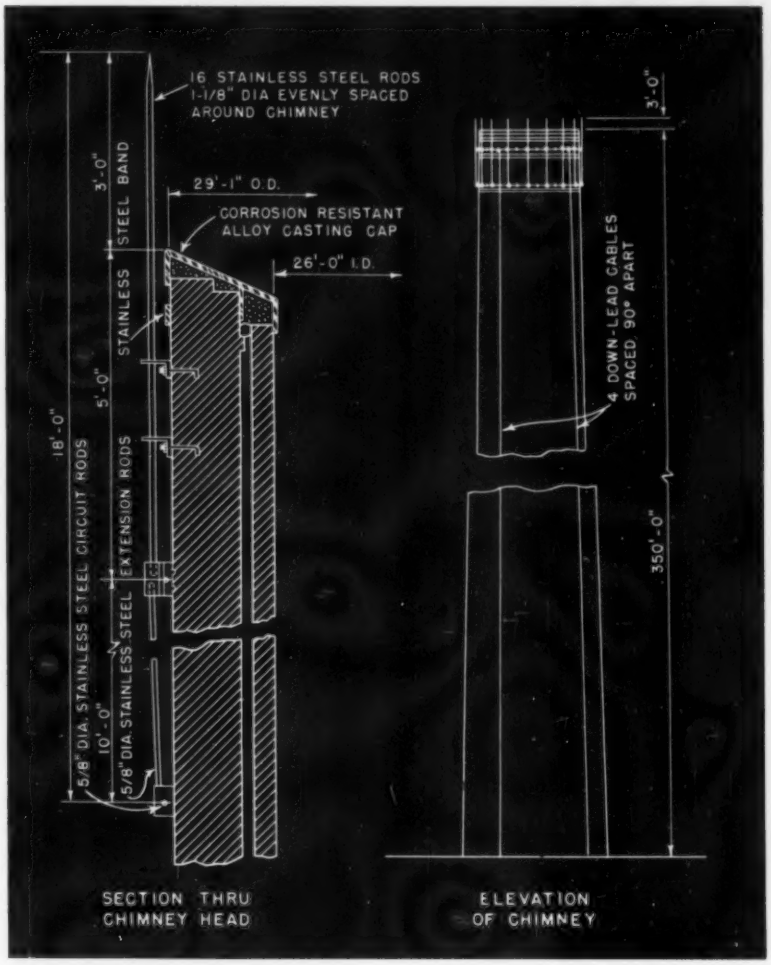

Don't Climb that Stack . . .

Use Stainless Lightning Arrestors

TALL smokestacks which are essential to certain refinery, chemical plant, and metal smelter operations provide ideal targets for lightning bolts during electrical storms. Such stacks are commonly equipped with conventional lightning arrestors which are subject to rapid deterioration in the presence of stack fumes.

At International Nickel's Port Colborne, Ont., nickel refinery, the top 75 ft. of a lead-coated copper lightning arrestor failed because of stack fume corrosion. Since maintenance and repair at the top of this 350-ft stack are expensive operations, that part of the old arrestor has been replaced with assembly made of Type 316 austenitic, Chromium-nickel, stainless steel. Inco is confident that no further maintenance or replacement will be required during the life of the stack itself.

The assembly, shown above, consists of circuit rods, points, brackets, bolts and supports. It is grounded out at four points, 90° apart, around the circumference of the stack. The stainless ground rods run down the stack about 75 ft. to join the old copper-lead lines at a point which had not been subject to appreciable corrosion.

Decision to use the 316 stainless was based on the excellent condition of the stack's top capping, made of similar material, after six years of constant contact with the stack fumes.

How to Cut Costs in Removing Old Welds

A TIME and money saving of 80% has been realized for most cutting, gouging, or metal removal jobs at Sohio Petroleum Corp.'s Covington, Ky., (Latonia) refinery by using the so-called "Arcair" torch.

This process, used for the past three

years by Sohio at Latonia, employs a compressed air jet to blow the slag away from the cut being made by the arc. In most cases the cut surface requires no re-work preceding the re-welding step.

Previously, the removal of old welds required tedious chipping, or burning with welding rods or acetylene, producing a slag ridge which necessitated further chipping or grinding before re-welding.

During the recent removal of damaged alloy storage tank liner plates, the torch did not leave any deposit of old spatter. This expedited the job of relining the tank. Other typical jobs performed by Sohio with the process include removing the steel bottom plates from a 55,000-bbl., floating roof tank to allow foundation repairs, and removal of defective welds from the inside of a 92 x 9-ft. diameter, steel vacuum column to allow re-welding.

Latonia personnel operates the torches on 100-psi. air pressure and 400 amp. from a DC welding machine. Ordinary No. 90 carbon electrodes, ¼ to ⅜-in., are used.

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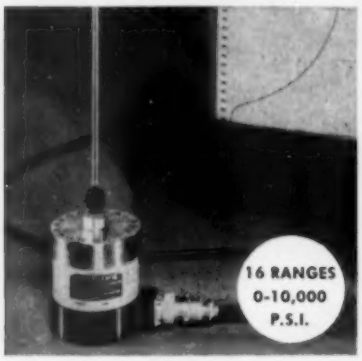

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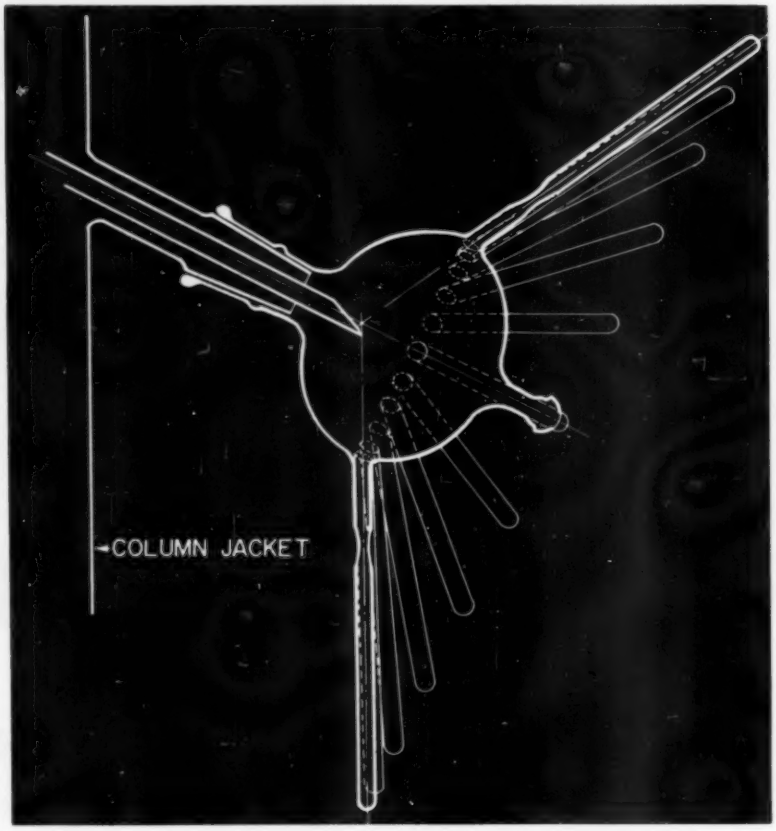

Unique Unit Handles Micro Fractions

By C. J. THOMPSON and H. J. COLEMAN*

THE unusual design of receiver shown above was developed to collect a series of small fractions during laboratory distillations and to avoid or minimize a number of undesirable features common to many other types of collection systems.

In operation, the distillate falls directly from the tip of the take-off arm of the column into the final receiver. This eliminates the need for stopcocks, thereby avoiding possible contamination of the sample with the stopcock lubricant.

Another advantage of this type receiver is that in semi-micro distil-

lations the distillate falls directly into the aligned receiving tube, this minimizing sample mixing and hold-up. After the desired amount of product has been collected in the collection tube, the device can be rotated on the standard tapered joint to align a new tube, and the previous fraction is then sealed off. This eliminates evaporation or interchange of vapors between fractions, and it makes available for immediate use the fraction removed, which is often desirable during extended distillations.

The chilling of the receiver tube directly below the column take-off arm with dry ice and maintaining the other tubes at room temperature or slightly higher will permit the handling of low-boiling liquids.

The receiver works equally well at atmospheric or reduced pressure. It is praticularly advantageous at reduced pressure in that pressure surges and fluctuations in ebullition, which often accompany the changing of receivers during vacuum distillations, are eliminated.

The technique avoids ingress of air and moisture and produces a fraction sealed in glass. A collection system as described here has been used with good results at the Bureau of Mines laboratory for atmospheric and vacuum distillation and with materials boiling as low as 50° C.

*The authors are associated with the Petroleum Experiment Station, Bureau of Mines, Bartlesville, Okla. This short article describes equipment developed during their work on the American Petroleum Institute Research Project 48A on "The Production, Isolation, and Purification of Sulfur Compounds and Measurement of Their Properties."

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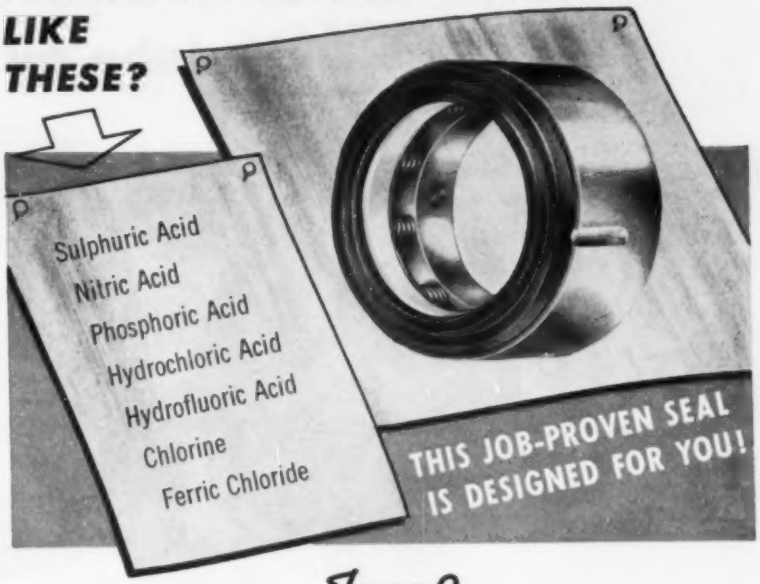
HANDLING CORROSIVES LIKE THESE?



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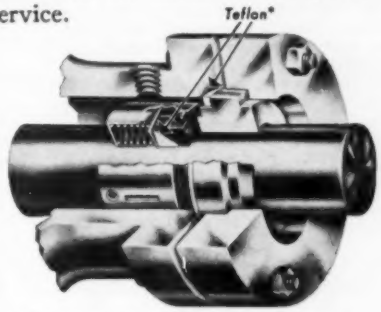

Your toughest problem can be the Type 9's next success story. Use it on all rotating shaft applications, including: centrifugal, rotary pumps, mixers, agitators, autoclaves, other equipment.

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Notice the difference in sludge on the oil screen and timing gear cover on the left as compared to the clean appearance of the corresponding parts at the right. Those on the left were operated on a representative heavy-duty motor oil (for service MS and DG). The cleanliness of those on the right resulted from the use of the same base oil to which only Du Pont Lube Oil Additive 564 plus an antioxidant had been added.

. . . polymeric additives offer solution to your low-duty sludge problems

A new solution to engine oil sludge problems, particularly those caused by low-power, low-temperature, and other low-duty driving conditions is now possible. This is especially significant in helping promote your product to the mass passenger car market, and is also of interest to the operators of urban fleets—taxis, buses and delivery services.

The solution of sludge problems is available through the use of new polymeric lube oil additives by Du Pont. Being outstanding detergents and viscosity-index improvers, these double-action additives are exceptionally effective under stop-and-go driving conditions. They are especially effective in retarding sludge formation on all engine parts in contact with lubricating oil. As a result, Du Pont Polymeric Lube Oil Additives help maintain good engine lubrication and extend the useful life of your customers' engines.

Leave No Deposit

Polymeric lube oil additives, being ashless detergents, permit more efficient operation of the engine oil system. Oil screens and filters are kept clean and free from sludge. The resulting free flow of oil through the engine keeps it in better operating condition.

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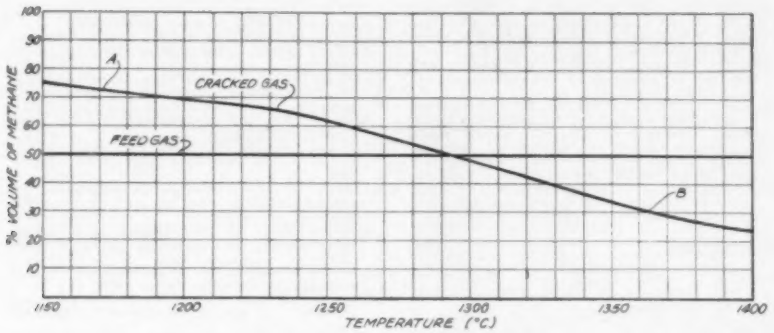
By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.



PERCENTAGE OF METHANE in cracked gas from feed, 50% methane, 50% propane

Acetylene, Ethylene Yields Are Good From Lean Stocks with New Process

A PROCESS is described by Koppers Co., Inc., in its patent No. 2,678,956 whereby lean stocks of mixed gases may be efficiently pyrolyzed to give good yields of unsaturates such as ethylene and acetylene. In the cracking of such lean feed stocks having only a small percentage of heavy saturated hydrocarbons, and in presence of methane, which improves operation, favorable results are obtained by maintaining the methane content at a certain value in the feed and in the cracked gas. That is, the methane in the feed preferably is held within the range of 50%-80% by dilution or otherwise, the balance of the feed stock being the heavier hydrocarbons such as ethane, propane, butane, oils, etc. The pyrolytic cracking is controlled by keeping the concentration of the methane in the cracked gas of the same order of magnitude (on the same basis) as in the feed (within 10%). This is claimed to permit use of lower temperatures in most cases.

Temperature, contact time, etc., are selected to maintain the specified methane concentration. The feed stock may be diluted with steam, if desired. Reasonably short contact times (not over 0.1 sec.) are employed. Cracking is accomplished by means of heat exchange at about 1100°-1200° C.

In the illustration the feed gas line is employed as the reference line, the methane content in the feed being 50%. The other curve (A-B) depicts the composition of the cracked feed gas at various cracking temperatures (1150°-1400° C.). Reference to Curve A shows that although the feed contains 50% methane, the cracked gas can contain as much as 75% methane. On the other hand, reference to Curve B will show that the methane content of the cracked gas may be as low as 23%. In one example, the lean feed contained 2.4% ethane, 32.6% propane and 65% methane. It was thermally cracked in a regenerative furnace with a steam dilution of 1:1. The temperature was 1225° C. and the content time was 0.091 sec. The cracked gas analyzed 0.3% CO_2, 9.3% C_2H_2, 5.2% C_2H_4, 0.7% C_6H_6, 0.0% O_2, 49.6% H_2, 1.8% CO, 32.1% CH_4 and 1.0% N_2.

The expansion during cracking in this case was 2.01 and, taking this into consideration, it will be noted that the methane content in the cracked gases, computed on the same basis as the feed gas, was about 64.5%. The acetylene yield (based on heavy hydrocarbon) was 36%, ethylene 19.8% (or a combined desired unsaturates yield of 55%), together with about 8.3% aromatics.

Methyl Triptene Production

A DESIRABLE high octane gasoline component is the polymer 2,2,3-trimethyl pentene, otherwise known as methyl triptene, which generally is prepared by copolymerization of 2-butene with isobutene in presence of catalysts (such as aluminasilica impregnated with nickel or cobalt oxide, described in patent No. 2,606,940).

In the Phillips Petroleum Co. patent No. 2,642,467, it is disclosed that, during the polymerization, the proportion of methyl triptene in the polymer decreases with increased time on stream. As the catalyst ages, the proportion of methyl triptene decreases and that of 2,2,4-trimethyl pentene increases. Since the methyl triptene, on hydrogenation, is of better octane number and has a better rich mixture performance than the 2,2,4-isomer, it is desirable to maintain a maximum proportion of the former.

A high 2,2,3-isomer content in the polymer is maintained by controlling the ratio of 2-butene to isobutene in the hydrocarbon feed in accordance with the age of the catalyst. With new catalyst, optimum production of 2,2,3-isomer can be obtained with a feed containing a relatively lower ratio of 2-butene to isobutene. Later on in the cycle, an increased ratio of 2-butene to isobutene is necessary. It is desirable to change the ratio from the range 5:1-14:1 when the catalyst is fresh, to the range of 18:1-25:1 when the catalyst has been on-stream, say, for about 3 to 6 hours. Other conditions include a temperature range of 30°-200° F., a liquid hourly space velocity of 1-20, and a pressure of 1-50 atmospheres.

Patents Issued Recently

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U.S. Patent Office for August 31, and September 7, 14, 21, and 28, 1954, Vols. 685 and 686, Nos. 5 and 1-4.

PROCESSES

Refining

2,688,374 (Union Oil Co. of Calif.) Adsorption process for separating gaseous mixtures.

2,688,587 (Standard Oil Development Co.) Solvent dewaxing mineral oil using 5-6C ketone and diethyl ketone.

2,688,645 (Socony-Vacuum Oil Co.) Solvent extracting hydrocarbons with cyclic organic carbonate solvent.

2,688,853 (Phillips Petroleum Co.) Process for removing vapors from gases, using heat exchange zones.

2,689,047 (Phillips Petroleum Co.) Pebble flow control for a pebble heat exchanger.

2,689,112 (Phillips Petroleum Co.) Cooler for gaseous suspension of a granulated solid.

2,689,164 (Humphreys & Glasgow Ltd.) Gas purification (removing H_2S in alkaline washing zones containing iron compound).

2,689,205 (Atlantic Refining Co.) Solvent refining of wax-containing mixtures, using phenol.

2,689,206 (Atlantic Refining Co.) Solvent refining of wax-containing mixtures, using pyridine.

2,689,207 (Universal Oil Products Co.) Desulfurization of oils with HF.

2,689,624 (Sun Oil Co.) Absorptive separation of methane and hydrogen.

2,689,625 (Sun Oil Co.) Absorptive separation of hydrocarbon gases.

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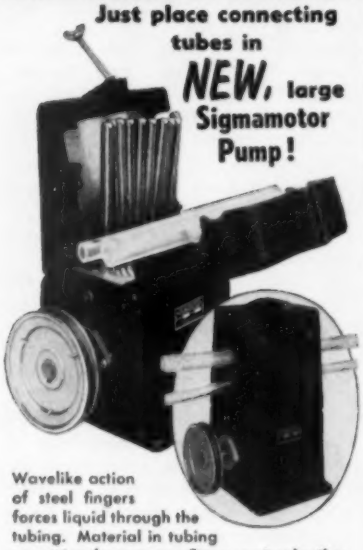

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New York 36, N. Y.

2,689,819 (Phillips Petroleum Co.) Sulfur dioxide extraction process.
2,689,820 (The Texas Co.) Dethiolizing hydrocarbons with caustic and glycol ether.
2,689,845 (Standard Oil Development Co.) Separating straight chains above C_6 with urea, etc.
2,689,873 (Phillips Petroleum Co.) Liquid-liquid solvent extraction.
2,689,875 (Phillips Petroleum Co.) Method and apparatus for treatment of high-pressure natural gas streams (dehydration, etc.).
2,690,060 (Phillips Petroleum Co.) Separating nitrogen from methane by fractionation.
2,690,417 (Standard Oil Co.-Ind.) Solvent refining cracked naphtha feed with anhyd. HF.
2,690,419 (Standard Oil Co.-Ind.) Recovery of spent doctor solution containing phenolics.
2,690,460 (Standard Oil Development Co.) Removal of primary alkyl halide from hydrocarbons in gasoline boiling range with bauxite.

Catalysts

2,688,401 (Standard Oil Co.-Ind.) Flotation of active catalyst from spent catalyst (using organic solvent).
2,689,226 (Universal Oil Products Co.) Manufacture and use of spheroidal catalysts of alumina and platinum.
2,690,432 (Standard Oil Co.-Ind.) Foam lift in chemical processing system for producing alumina sols.
2,690,433 (W. F. Engel, et al) Group VI and VIII catalyst by impregnation.

Conversions

2,688,464 (Socony-Vacuum Oil Co.) Process for thermally working oil shale.
2,688,588 (Deep Rock Oil Corp.) Process for handling gas-particle mixtures in catalytic conversion, using fluidized system.
2,688,646 (Standard Oil Development Co.) Two-stage olefinic polymerization process.
2,689,208 (Universal Oil Products Co.) Hydrocarbon conversion process by reforming with alumina and Pt, etc.
2,689,209 (Phillips Petroleum Co.) Catalytic treatment of hydrocarbons in fluidized system.
2,689,210 (Universal Oil Products Co.) Method and apparatus for effecting the conversion of reactants in contact with particulated solid material in fluidized system.
2,689,212 (A/B Svenski Maskinverken) Process and device for destructive distillation of solid carbonaceous material.
2,689,265 (Standard Oil Development Co.) Method for preparing aromatics from C_6 hydrocarbons, using molybdate catalyst.
2,689,266 (Socony-Vacuum Oil Co.) Naphthalene production from methyl naphthalene, using NiO-chromia, etc.
2,689,267 (Standard Oil Development Co.) Polymerization of olefins employing granular catalyst.
2,689,786 (Otto Hubmann) Process for the gasification of solid fuels, using oxygen.
2,689,787 (Standard Oil Development Co.) Volatile fuel production from carbonaceous solids, using oxygen.
2,689,821 (Union Oil Co. of Calif.) Hydrocarbon conversion process in presence of hydrogen and cobalt molybdate catalyst.
2,689,822 (Socony-Vacuum Oil Co.) Quenched hydrofluoric acid conversion of naphtha.
2,689,823 (Standard Oil Development Co.) Fluid hydroforming process.
2,689,824 (Gustavo Goll) Catalytic process and apparatus for the conversion of mineral oil residues (asphalts) into gasoline, etc., using electrically conductive and catalytic metal.
2,689,825 (Gulf Research & Development Co.) Removal of metals from petroleum hydrocarbons (using catalyst fines) followed by fluidized cracking.
2,689,973 (L. V. Lee, et al) Fluidizing reactor.

Hydrocarbon Synthesis

2,688,629 (Standard Oil Development Co.) Method for controlling a hydrocarbon synthesis reaction.
2,688,630 (Standard Oil Development Co.) Treatment of the hydrocarbon synthesis products.
2,689,252 (Phillips Petroleum Co.) Hydrocarbon synthesis and catalyst therefor.
2,690,449 (The Texas Co.) Hydrocarbon synthesis and iron catalyst therefor.

PRODUCTS

Chemicals

2,688,591 (Standard Oil Co.-Ind.) Purification of OXO-process aldehydes by distillation.
2,688,592 (Diamond Alkali Co.) Photochemical process for producing carbon tetrachloride by chlorination of methane.
2,688,605 (Phillips Petroleum Co.) Compounding polybutadiene with carbon black.
2,688,611 (Phillips Petroleum Co.) Barium salt of sulfated lignin.
2,688,627 (Standard Oil Development Co.) Dicyclopentadiene carboxylic acids.
2,688,631 (California Research Corp.) Process for preparing dicyano stilbenes.
2,688,633 (Standard Oil Development Co.) Sulfonation of alkyl aromatic hydrocarbons.
2,688,640 (Farbenfabriken Bayer Akt.) Diketene.
2,688,641 (Ethyl Corp.) Manufacture of ethyl chloride.
2,688,642 (Dow Chemical Co.) Dichloropropenes by chlorination of propylene and monochloropropenes.
2,688,644 (Standard Oil Development Co.) Purification of metaxylene.
2,688,647 (Phillips Petroleum Co.) Vulcanizable natural rubber containing sulfenamide antioxidant.
2,689,040 (Phillips Petroleum Co.) Processing of sulfur-vulcanizable materials and related compositions and articles.
2,689,221 (Bray Oil Co.) Method of purifying, concentrating, and converting petroleum sulfonates
2,689,229 (Standard Oil Development Co.) Regeneration of ion-exchange materials.
2,689,241 (M. W. Kellogg Co.) Polymerization of fluorine-containing monomers in aqueous Redox system.
2,689,253 (Celanese Corp. of America) Oxidation of C_4 hydrocarbons.
2,689,258 (Standard Oil Development Co.) Reaction of terpenes with thiophosphorous acid esters and products thereof.
2,689,835 (Standard Oil Development Co.) Synthetic copolymer of methylpentadiene and cyclopentadiene.
2,689,855 (Phillips Petroleum Co.) Production of alkenylthiophenes.
2,689,867 (Phillips Petroleum Co.) Preparation of alkyl aminosulfides.
2,690,389 (Phillips Petroleum Co.) Lime-treated diatomaceous earth as a parting agent for ammonium nitrate.
2,690,457 (Shell Development Co.) Production of unsaturated carbonylic compounds by oxidation of an olefin in presence of cuprous oxide with palladium.
2,690,458 (Ethyl Corp.) Trichlorobenzene free of tetra.
2,690,459 (M. W. Kellogg Co.) Perhaloolefin containing 3F.

Fuels

2,688,534 (Standard Oil Development Co.) Segregation and peak load use of ethane in natural gas.
2,688,628 (Ethyl Corp.) Manufacture of alkyl lead compounds.
2,688,840 (Phillips Petroleum Co.) Paraffin hydrocarbon fuel for and method of operating pulse jet engines (not over 10% isoparaffine, 5-20% normal paraffine in 20-150°F. range, etc.)
2,688,875 (Phillips Petroleum Co.) Airplane fuel gauge.
2,689,171 (U. S. A.) Identifying gasoline and the like (secretly marked with diazotizable amine).
2,689,172 (J & S Carburetor Co.) Engine fuel gas metering device.
2,689,791 (Ethyl Corp.) Process for recovering sodium from sludge.
2,690,386 (U. S. A.) Halogenated acetylenes as fuel components.

Lubricants

2,688,595 (Standard Oil Co.-Ind.) Lubricant containing aromatic amino salt as corrosion and oxidation inhibitor.
2,688,596 (Standard Oil Development Co.) Stabilizing polymers of vinyl ether additives by heating oil solution.
2,688,612 (Standard Oil Co.-Ind.) Preparation of phosphorous sulfidehydrocarbon reaction products and removal of inorganic phosphorous acids therefrom.
2,688,643 (Standard Oil Development Co.) Alkylated aromatics for pour depressants.
2,689,220 (California Research Corp.) Lubricating oil compositions of mixed diester dithiophosphates (zinc salts).
2,689,222 (Standard Oil Development Co.) Soluble cutting oil containing sulfonate, sulfurized fatty oil, sorbitan ester, etc.
2,689,223 (Standard Oil Development Co.) Viscosity index improvers (isoolefindiolefin copolymer and P.S. compound).
2,689,224 (Honorary Advisory Council for Scientific & Indust. Research) Friction reducing additives for lubricants (alkyd resins).
2,689,827 (American Cyanamid Co.) Lubricating oil composition containing the neutralized reaction product of a phosphorus sulfide and sugar cane oil.
2,689,828 (Gulf Oil Corp.) Mineral oil compositions containing amine salt corrosion inhibitor.
2,689,846 (American Cyanamid Co.) Terpene-phosphorous pentasulfide-sulfur lubricating oil additive.
2,690,426 (Atlas Powder Co.) Lubricating composition containing polyoxyethylene ethers of hexitols.
2,690,429 (Standard Oil Development Co.) Grease containing aryl oxy alkyl salt stabilizer.

Patents

2,690,445 (Standard Oil Development Co.) Sulfurized sperm oil lubricating oil additives stabilized with sulfites.

Specialties

2,688,157 (Standard Oil Co.-Ind.) Positioning means in candle making.
2,688,597 (Standard Oil Development Co.) Insulating oils treated with 2,6 di-tert-butyl 4-methyl phenol.
2,689,173 (Atlantic Refining Co.) Process of treating soil with alkyl benzene sulfonate.
2,690,396-7 (Universal Oil Products Co.) Stabilizing edible materials with 2-tert-alkyl-4-alkoxy phenol and lecithin.
2,690,413 (Socony-Vacuum Oil Co.) Fumigation with acetylated halogenated thiophene.
2,690,418 (Standard Oil Development Co.) Upgrading residual oil to asphalt by reaction with carbon tetrachloride.
2,690,420 (Standard Oil Development Co.) Paving asphalts by precipitating out 5-20% asphaltenes.

Miscellaneous

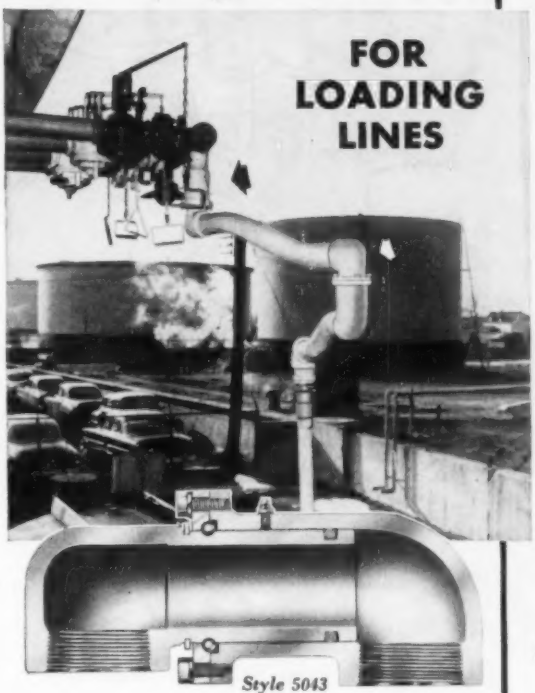
Re 23,877 (Phillips Petroleum Co.) Tube sockets for printed circuits.
2,688,386 (Standard Oil Development Co.) Device for adjusting brakes automatically.
2,688,589 (Sinclair Refining Co.) Oil refinery heater of the vertical cylindrical all-radiant upshot fired type.
2,688,771 (Universal Oil Products Co.) Liquid feeding and distributing device.
2,688,866 (Pan American Refining Corp.) Hydrocarbon dew point indicator.
2,688,868 (Continental Oil Co.) Specific gravity meter.
2,688,869 (Standard Oil Development Co.) Precision microviscosimeter.
2,688,870 (Kent-Moore Organization, Inc.) Gasper-mile gauge.
2,689,142 (Phillips Petroleum Co.) External packing device for pipe fittings.
2,690,078 (Leeds & Northrup Co.) Radiator temperature measurement.

EQUIPMENT

Processing, general

2,687,626 (Bohn Aluminum & Brass Corp.) Heat exchanger having open-sided bore superimposed on closed bore.
2,687,708 (Babcock and Wilcox) Vapor generating unit with rise platens thru gas chamber.
2,687,780 (Frank R. Culhane) Gas cleaning apparatus.
2,687,843 (John Foster Alcock) gas pressure exchanger.
2,687,876 (Aktiebolaget Seperator) Plate-type heat exchanger.
2,687,877 (E. T. Oakes Corp.) Apparatus for mixing and processing.
2,687,948 (Paul Gregory and Michailas Genas) Apparatus and method for thermal operations.
2,688,069 (Clark V. Combest) Steam generator.
2,688,196 (Joao de Oliveira Torres) Drying or desiccating device for granular material.
2,688,287 (Pioneer Gen-E-Motor Corp.) Hydraulic pump.
2,688,315 (Babcock and Wilcox) Heat exchanger handhole fitting.
2,688,362 (Miller Oil Burner Co.) Gravity fed, liquid fuel pilot-type oil burner.
2,688,374 (Union Oil Co. of Calif.) Adsorption process and apparatus.
2,688,376 (Daniel T. Oertel) Air scrubber.
2,688,378 (Sulzer Freres, Society Anonyme) Apparatus for delivering gases, including means for separating out entrained particles.
2,688,402 (Clerite Corp.) Apparatus and method for removing particles from a liquid.
2,688,404 (Walter Wahl) Thermal diffuser separator.
2,688,405 (Sharples Corp.) Centrifuge construction for separating solids from liquids.
2,688,406 (Arthur A. Holland) Filtering apparatus.
2,688,437 (Society Anonyme de St. Gobein) Centrifugal separator.
2,688,466 (Babcock and Wilcox) Fluid-heating apparatus.
2,688,531 (Allied Chemical and Dye Corp.) Production of hydrocyanic acid.
2,688,533 (Carl Otto) Spray reactor crystallizer for ammonia.
2,688,589 (Sinclair Refining Co.) Heater.
2,688,682 (Ethyl Corp.) Liquid handling and transporting appartus.
2,688,794 (General Electric Co.) Method of making heat exchange apparatus.
2,688,854 (Chemical Construction Co.) Process and apparatus for the separation of oxygen from air.
2,688,925 (Thompson Products, Inc.) Mixed flow multiple pump.
2,688,942 (Babcock and Wilcox Co.) Steam generating and combustion system and method.
2,688,986 (General Motors Corp.) Heat exchanger.

BARCO Swing Joints



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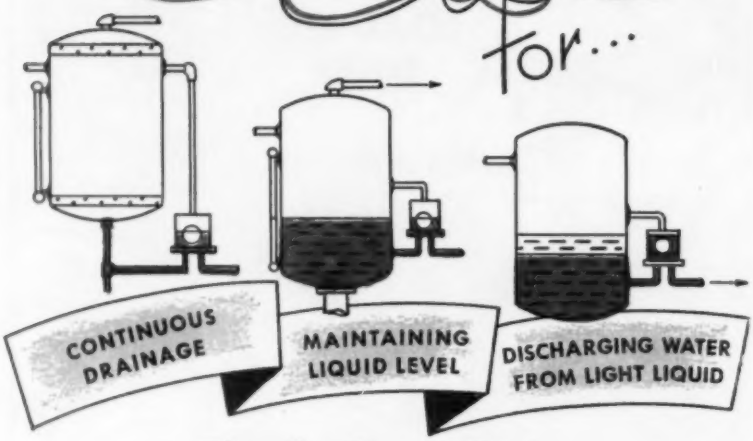

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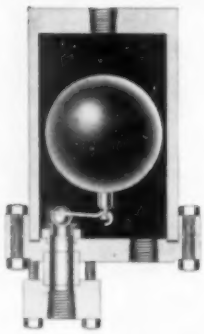

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Patents

2,689,000 (Babcock and Wilcox and Bailey Meter Co.) Furnace lighter with cam interlocked air-operated controls.
2,689,001 (Leyle V. Leysen) Fluid fuel burner.
2,689,018 (American Water Softener Co.) Apparatus and method for deaerating water.
2,689,020 (Henry J. Hersey, Jr.) Dust filter.
2,689,047 (Phillips Petroleum Co.) Pebble flow control for a pebble heat exchanger.
2,689,112 (Phillips Petroleum Co.) Cooler for gaseous suspension of a granulated solid.
2,689,153 (Sun Oil Co.) Elevation of granular solids.
2,689,212 (A/B Svenska Maskinverken) Process and device for destructive distillation.
2,689,296 (Ohio Crankshaft Co.) Means and method of high-frequency induction heating.
2,689,623 (Carl L. Schebler) Apparatus for separating liquid entrained or carried by a gas or vapor.
2,689,905 (Willis F. Harris) Liquid heater.
2,690,172 (William Jos. Miller) Apparatus for heating and handling asphalt.
2,690,189 (Robertshaw-Fulton Controls Co.) Control apparatus for fuel-burning appliances.
2,690,213 (Jos. Lucas Ltd.) Fluid fuel burner and combustion air louver.
2,690,327 (Pako Corp.) Apparatus for heating and cooling liquids.
2,690,328 (W. J. Keesling) Heat exchanger.
2,690,329 (Alpura, A. G.) Device for homogenizing liquids.
2,690,332 (Foster Wheeler Corp.) Bubble tower.

Catalytic Reactors

2,688,195 (Phillips Petroleum Co.) Fluidized catalyst stripping apparatus.
2,689,211 (Phillips Petroleum Co.) Method and apparatus for cracking hydrocarbon oils.
2,689,267 (Standard Oil Development Co.) Polymerization of olefins employing granular catalyst.
2,689,824 (Gustavo Goll) Catalytic process and ap- with rate-action.
2,689,973 (Lewis V. Lee, Fred Krause, and Morton T. Powel) Apparatus for contacting solids with gases.
2,690,056 (Socony-Vacuum Oil Co.) Hydrocarbon conversion process and apparatus.
2,690,057 (Socony-Vacuum Oil Co.) Process and apparatus for cooling particle-form solid contact material.
2,690,267 (Mississippi Chemical Corp.) Catalyst loading and baffle tool.
2,690,384 (Lummus Co.) Gas producer.

Instruments

2,687,646 (Daniel and Florence Guggenheim Foundation) Apparatus for measuring the rate of flow in pipes.
2,687,748 (Daniel Orifice Fitting Co.) Orifice plate assembly.
2,688,251 (William D. Kelly) Liquid level indicating means.
2,688,253 (Hagan Corp.) Pressure differential responsive device.
2,688,300 (Madden T. Works) Alarm system.
2,688,314 (Smallpiece Ltd.) Control means for a double-acting pressure responsive device.
2,688,334 (Leeds & Northrup Co.) Control system paratus for the conversion of mineral oil residues.
2,688,866 (Pan American Refining Corp.) Hydrocarbon dew-point indicator.
2,688,867 (Foster J. Trainor) Specific gravity indicator.
2,688,868 (Continental Oil Co.) Specific gravity meter.
2,688,869 (Standard Oil Development Co.) Precision microviscosimeter.
2,688,874 (Rockwell Mfg. Co.) Fluid meter.
2,688,876 (Robert H. Barnes) Temperature-measuring device.
2,688,987 (Daniel Orifice Fitting Co.) Orifice fitting device.
2,689,088 (Bailey Meter Co.) Control system.
2,689,332 (Air Reduction Co.) Magnetic gas analyzer.
2,689,477 (Bailey Meter Co.) Apparatus for measuring heating value of fuels.
2,689,478 (Bailey Meter Co.) Calorimeter.
2,689,479 (Minneapolis-Honeywell Regulator Co.) Humidity-measuring apparatus.
2,689,550 (Granberg Corp.) Liquid meter.
2,690,079 (Liquidvision Gauge and Control Corp.) Pressure compensating gage.
2,690,093 (Unicam Instruments Ltd.) Apparatus for ascertaining the absorption spectrum of transiucent fluid substances.
2,690,154 (Franz Boos) Fluid flow indicator.
2,690,155 (Lucius F. Gary) Liquid level indicator.
2,690,462 (General Motors Corp.) Thermocouple.
2,690,484 (Christian J. Van Eyk) Float switch.

Pumps & Compressors

23,870 (Robbins and Myers Inc.) Flat rotary pump.
23,872 (Robbins and Myers Inc.) Flat rotary pump.
2,687,615 (Shallcross Controls) Radial-type hydraulic pump.
2,687,696 (Elmer E. Theis) Diaphragm pump.
2,687,842 (Christopher A. Armstrong) Direct reciprocatory drive for motor-driven compressors.

Patents

2,689,529 (General Electric Co.) Submersible pump-motor.
2,689,532 (International Business Machine Corp.) Nonrotating multipiston radial pump.
2,698,533 (Carter Carburetor Corp.) Liquid pump.
2,689,680 (Rolls Royce Ltd.) Means for regulating the characteristics of multistage axial-flow compressors.
2,689,681 (United Aircraft Corp.) Reversely rotating screw-type multiple impeller compressor.
2,689,682 (A. V. Roe Canada Ltd.) Gas turbine compressor.
2,690,128 (North American Solvay Inc.) Electromagnetic pumping device.
2,690,129 (Hydrojet Corp.) Self-priming pump.
2,690,130 (Hydrojet Corp.) Centrifugal pump unit.
2,690,131 (Pekor Iron Works) Sand pump.
2,690,133 (New York Air Brake Co.) Pump.
2,690,291 (American Television, Inc.) Control apparatus for vacuum pumping systems.
2,690,292 (Specialties Development Corp.) Unloading system for compressors.
2,690,293 (Westinghouse Electric Corp.) Fan.
2,690,294 (Hayes Industries) Blower.
2,690,295 (Air Mass, Inc.) Air pump.

Tanks

2,687,618 (Socony-Vacuum Oil Co.) Safety storage system for liquefied hydrocarbons.
2,687,822 (Gunnar Lindwall) Barrel.
2,689,461-462 (Clarence W. Brandon) Method and apparatus for the storage, refrigeration transportation of volatile liquids and other fluids.
2,690,273 (Chicago Bridge and Iron Co.) Elevated storage tank.

Valves & Fittings

2,687,738 (Milwaukee Gas Specialty Co.) Combined control and safety shutoff valve.
2,687,742 (Standard Oil Development Co.) Valve apparatus for steam control valves.
2,687,743 (New York Brake Co.) Pressure-reducing valve with over-pressure release.
2,687,744 (Arthur W. Sear) Fast acting valve.
2,687,745 (Norman H. Hackett) Safety shutoff valve for fluid pipe lines.
2,687,841 (Russell C. Churchman) Valve used as a control.
2,687,868 (Curtiss-Wright Corp.) Flow control valve.
2,687,869 (Borg-Warner Corp.) Flow restrictor valve.
2,687,870 (Milwaukee Gas Specialty Co.) Electromagnetic control device.
2,687,905 (Pacific Pipe Co.) Pipe coupling with cam disengagement pivoted detent means.
2,688,336 (Minneapolis-Honeywell Regulator Co.) Valve.
2,688,337 (Minneapolis-Honeywell Regulator Co.) Delay action valve.
2,688,339 (Fred H. Dexter) Dispensing mixing valve.
2,688,340 (St-West, Inc.) Pressure-equalizing valve with pivotally mounted operator.
2,688,341 (Paul A. Dewhirst) Valve.
2,688,342 (Machine Tool Works Oerlikon, Zurich-Oerlikon) Control device.
2,688,462 (Johns-Manville Corp.) Noncorrosive valve.
2,688,974 (Minneapolis-Honeywell Regulator Co.) Control device.
2,688,977 (Howard and John Droitcour) Relief valve.
2,688,978 (Detroit Controls Corp.) Liquid flow check valve.
2,688,979 (John F. Kendrick) Abrasion resistant check valve.
2,688,981 (Greer Hydraulics) Valve.
2,689,106 (O. L. Miller) Valve assembly.
2,689,580 (Sun Oil Co.) Pressure relief valve.
2,689,581 (Kunkle Valve Co.) High-pressure safety relief valve.
2,689,670 (Thompson Products, Inc.) Relief valve for submerged pumps.
2,689,959 (Elier Co.) Pop-up waste valve.
2,690,190 (John W. Farrell) Differential pressure control valve.
2,690,191 (Alfred J. Mosley) Vent valve.
2,690,193 (Telford L. Smith) Pipe clamp.
2,690,201 (Elastic Stop Nut Corp. of America) Self-locking nut.
2,690,275-276 (American Locomotive Co.) High-pressure closure.
2,690,322 (Edgar Stansfield) Tap, valve, etc.
2,690,359 (Wagner Electric Corp.) Emergency relay valve.
2,690,360 (Foxboro Co.) Pressure-tight seal.

How to Obtain Patents

Readers may obtain copies of any U.S. patent from the Patent Office at 25¢ each. Order by patent number direct from The Commissioner of Patents, Washington 25, D.C.

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PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROHOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Trideeyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
	Iso-Octyl Alcohol	Tetrapropylene
	Decyl Alcohol	Tripropylene
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		Benzene
		Acetone
		Methyl Ethyl Ketone

ENJAY CO., INC. • 15 West 51st Street, New York 19, N. Y.

FATHER OF THE MAN, Dr. Roger Richardson, of Standard Oil Development's Esso Laboratories, has attended the development of a tennis champion in his son "Ham" Richardson. Father and son occasionally combine for some effective doubles play, as in the picture above, taken when they successfully defended their 1953 title as National Father and Son's Doubles Champs at Brookline, Mass., in August. When not himself playing, Dr. Richardson comes up from Baton Rouge to watch Ham pick up titles, like the National Intercollegiate cup and the 1954 Newport Invitational.

Dr. H. H. Wollthan of Leverkusen, Germany, has been elected a vice-president and appointed technical director in charge of production, engineering and research of the Mobay Chemical Co. The firm is jointly owned by the German company Farbenfabriken Bayer, A. G., and Monsanto Chemical Co. It was formed to produce isocyanate chemicals in the United States.

Dr. Wollthan was in charge of isocyanate chemicals production for the German firm prior to his latest promotion.

Robert G. Kittner has been chosen to be development director of Mobay. He was selected from the development department of Monsanto's research and engineering division, where he was assistant director. He joined Monsanto in 1951.

Research director of Mobay is **Dr. Edgar E. Hardy,** formerly associate director of research for the Monsanto inorganic chemicals division. He began with the company in 1942 as a research chemist and became assistant director of divisional research in 1950.

General manager of sales is **James D. Mahoney,** who was in charge of isocyanate sales for Monsanto's organic chemicals division. He joined the company in 1940 as a member of the research department at Everett, Mass., and also served there in the sales and sales development departments before transferring to the organic chemicals division in 1953.

M. Halpern, vice-president in charge of refining for The Texas Co., has been elected senior vice-president, a new executive post. A graduate of New York University with a degree in civil engineering, Mr. Halpern began with The Texas Co. in 1916 as assistant civil engineer at the Bayonne, N. J., refining terminal. He held various supervisory positions at the company's terminals and refineries, transferring in 1930 to New York as assistant manager of the refining department. He became general manager of the department in 1938, a vice-president in 1940 and a director of the company in 1946.

Mr. Halpern

Mr. Halpern has been replaced as vice-president for refining by **J. S. Worden,** formerly general manager of refining. Mr. Worden is a graduate of the Lawrenceville School and Princeton University. He joined the company in 1921 at the West Tulsa, Okla., refinery, later becoming its assistant superintendent.

Mr. Worden

Mr. Mangelsdorf

He was promoted to assistant manager of The Texas Co.'s refining department in 1940, manager of operations in 1942, and general manager in 1950.

The new general manager of the refining department is **Theodore A. Mangelsdorf,** manager of the department's operations division since last year.

A member of the teaching staff of Massachusetts Institute of Technology from 1926 until he joined the company in 1933, Mr. Mangelsdorf spent his first nine years with Texaco at the Port Arthur refinery. In 1942 he became assistant superintendent of the Lockport, Ill., refinery and five years later the superintendent. He returned to Port Arthur as general superintendent in 1950 and went to New York in 1953 as general manager of the refining department.

F. H. Holmes has been promoted from assistant general manager of refining to vice-president in charge of the newly created research and technical department, formerly a division within the refining department.

Mr. Holmes

Dr. Kuhn

Mr. Holmes has worked for the company since his graduation from Yale University in 1927.

He became assistant manager of operations of the department in

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1950, and in 1953 asst. gen. manager.

General manager of the research and technical department is **Dr. Wayne E. Kuhn,** who served as manager of these activities when they had only divisional status in the company.

Dr. Kuhn joined The Texas Co. in 1929 and worked for eight years at the Port Arthur refinery, being transferred then to New York headquarters. In 1938 he became manager of the research and technical division.

Dr. E. C. Hughes, chief of the chemical and physical research laboratory of Standard Oil of Ohio's manufacturing department, has taken the post of research manager, a new position which gives him responsibility for all physical and chemical research conducted by the company, excluding that carried on by the production department. This reorganization is intended to initiate an expanded program of research, especially in petrochemicals.

Dr. Hughes

A change in the petrochemical department has brought **Donald G. Stevens,** formerly chief of the manufacturing department's technical service division, into the department as plant manager of the new Lima petrochemicals plant, currently under construction. Mr. Stevens joined Sohio in 1941 as a chemical engineer in the technical service division, where he became chief in 1949.

Mr. Stevens

Mr. Ryan

The former assistant to the company's vice-president for manufacturing, **Granville B. Ryan,** also has been transferred into the petrochemical department, where he has been made manager of the market and product development division. Mr. Ryan entered the company in 1939. Since 1947 he has served as assistant to the

manufacturing department's vice-president.

William H. Ringler has become Mr. Ryan's assistant. He was formerly the technical service division's senior engineer and was in the division from the time he joined the company in 1948.

Paul D. Williams has been appointed acting secretary-treasurer of the Western Petroleum Refiners Assn., where he has been serving as technical director for the past 10 years. He succeeds **John C. Day,** who died October 5.

Mr. Williams

Before joining the staff of the WPRA, Mr. Williams was associated with the Globe Oil & Refining Co., Blackwell, Okla.; the old Omar Refining Co., Garber, Okla.; and the Lairo Oil & Gas Co. He also served for four and one-half years as chief chemist for the oil and gas conservation department of the Oklahoma Corporation Commission.

A. L. Lyman, formerly executive vice-president of California Research Corp., is now president of the corporation, a subsidiary of the Standard Oil Co. of California. He has succeeded **H. G. Vesper,** who has been transferred to California Standard to direct marketing, supply and transportation in the western area.

Mr. Lyman joined Standard in 1924, following his graduation from the University of California. He became manager of the Richmond laboratories in 1938 and a director of the research company in 1944. He was made executive vice-president in 1953.

A graduate of the California Institute of Technology, Mr. Vesper began with Standard in 1922 at the El Segundo refinery. He worked first in research and development and then in marketing, being named manager of gasoline and fuel oil sales in 1942. He was made a vice-president of Standard in 1952 and was president of the research company for the eight years preceding his latest promotion.

California Standard also has appointed **Fred Powell** general manager of the company's manufacturing department, to succeed **O. N. Miller,** now a vice-president of the company. Mr. Powell was formerly president of California Research and Development Corp., a subsidiary organization that was dissolved earlier this year upon completion of its contracts with the Atomic Energy Commission. Since then he has been serving as assistant manager of manufacturing.

Mr. Powell is a graduate of the University of Washington. He joined California Standard in 1925 and was at one time manager of the El Segundo refinery.

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The recent expansion program at the Shellburn Refinery of the Shell Oil Company of Canada, Limited, has been completed by The Fluor Corporation of Canada, Ltd., a subsidiary of The Fluor Corporation. Capacity of the refinery was raised to 15,000 barrels daily by revisions to the distilling and thermal cracking facilities, and by adding a vacuum flashing unit, a fluid catalytic cracking unit, polymerization and auxiliary treating facilities, a gas recovery plant, and other related equipment. Engineered and built by Fluor, this job is typical of the top quality engineering and construction work done by Fluor on similar projects all over the world.

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 (To obtain more data on advertised products see page 1784)

ELECTRODATA CORP.'S COMPUTER COLLEGE in session "on campus" at the company's plant in Pasadena, Calif. Students here are learning to translate a business problem into the code language of the computer. ElectroData gives a two-week course in general computer operation for management, supervisory and technical personnel. An intensive three-week program is offered to representatives of firms that have ordered computing equipment to prepare them to be operators when the machines are installed

Robertshaw Division to Relocate

The Bridgeport thermostat division of Robertshaw-Fulton Controls Co. plans to relocate in a $2,000,000 plant now under construction at Milford, Conn., six miles from Bridgeport. The same line of products is to be manufactured in the new plant, though the 15-acre tract doubles the present manufacturing area and thus allows for any expansion the company might want to undertake. The new plant will be ready in June of 1955, and the division's present quarters eventually will be sold.

Beckman Sets up New Group

Complete engineering service for the design, construction and installation of industrial recording and control systems is being provided by an engineering group set up recently by the Berkeley division of Beckman Instruments, Inc., Richmond, Calif.

Fluor-Singmaster & Breyer Merge

A majority interest in Singmaster & Breyer, Inc., New York City, has been purchased by the Fluor Corp., Ltd., engineering, construction and manufacturing firm of Los Angeles, Calif. While details of the merger were not disclosed, it was reported that Fluor has taken control of 55% of Singmaster & Breyer stock.

The two organizations plan to operate in conjunction with each other to provide such services as consultations and reports on technical, economic and business aspects of the industry; the design of processes and equipment; procurement, construction, supervision and management, and the starting and adjusting of new plants.

Chem. Engineer Turns Consultant

Edmund A. J. Mroz, formerly with the process engineering department of Stone & Webster Engineering Corp., has opened a chemical engineering consulting service for small and medium-size new England industry. Mr. Mroz joined Stone & Webster at the end of World War II and engaged in bubble-tray research under the late W. A. Peters, Jr. His work also included experience in project and process engineering at oil refinery and chemical plant installations in the United States, Canada, France and Kuwait.

Mr. Mroz

Mr. Mroz is a graduate of Northeastern University, where he was awarded a B.S. degree in chemical engineering in 1942. While a student he fulfilled a cooperative work assignment at the laboratory of the Eastern Gas and Fuel Associates, Everett, Mass.

Mr. Mroz has his offices at 17 Harrison St., Melrose 76, Mass.

Panellit-T&C Form Affiliate

Marketing and application engineering of data-reduction equipment manufactured by Taller & Cooper, Inc., Brooklyn, N. Y., will be handled by a new division of Panellit, Inc., Skokie, Ill., known as the Tal-Cooper division. The Panellit firm makes a variety of process control, data-reduction and information system equipment, and the affiliation with Taller & Cooper is expected to enable Panellit to cover a wider area of this field.

Products to be handled by the new division include digital converters, analog printers, gas detectors and SARA, the name for automatic trouble-shooting systems used in power projects.

Donegal Forms New Casting Div.

High quality return bends and other cast fittings will be produced for the petroleum and chemical industries by the newly established refinery steel castings division of the Donegal Manufacturing Corp., an electric steel foundry at Marietta, Pa.

Operations of the new division are being directed by Gerald C. Smith, vice-president and general manager of the division, who was formerly with the Key Co. Director of design and engineering is Merle E. Burkhart, formerly a member of the consulting firm of K. P. Wesseling & Co.

Personnel Changes

Calumet & Hecla, Inc.—Edgar K. Schutz and Robert Allan to sales representatives; Thomas E. Goodyear to representative in the company's new office at Moline, Ill. All are in the Wolverine Tube Division.

Lummus Co.—Dr. Raymond C. Johnson to the technical staff, from vice-president in charge of research for the Anthracite Institute.

Ebasco Services, Inc.—Lee Hanower to business analyst in petrochemical and plastics fields.

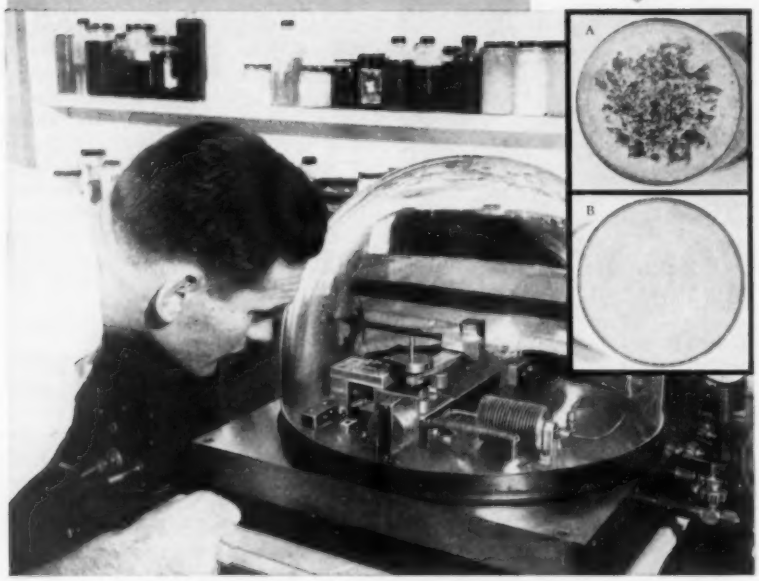
Farris Engineering Corp.—Robert N. Gierse to sales manager of the Farris Flexible Valve Corp., an affiliated company.

ORONITE
LUBE OIL
ADDITIVES

Photo "A" Shows excessive wear on valve lifter head from the use of oil having inadequate anti-wear properties.

Photo "B" Shows valve lifter head properly lubricated with oil containing Oronite lube oil additives.

(Valve lifters were taken from cars operated in normal passenger service.)



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Oronite's research and testing facilities are the most advanced in the nation. With years ahead research it is possible that Oronite additives could provide your finished oil with advantages to win and hold a market.

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ORONITE CHEMICAL COMPANY

Suppliers

CEC Instruments Inc.—Frank E. Chase to manager of the New York district office.

Parker Appliance Co.—J. H. "Jack" Stickney to sales engineer in northern Indiana, central Illinois, Wisconsin and Minnesota; J. H. "Jim" Atkinson to district manager for Texas, New Mexico, Louisiana, Arkansas and Mississippi, with headquarters in Houston.

Rhodia, Inc.—H. C. Nichols to head of the engineering service section of the industrial reodorants ("Alamask") division; Warren B. Thompson to sales representative in the middle Atlantic states, with headquarters in Philadelphia.

Powell Valves—William Morrison to sales representative in the New York area.

Carver Pump Co.—James E. Kuppe to general sales manager, with headquarters in Muscatine, Ia.

Barnes Mfg. Co.—Frank Sparks to southwestern district manager, covering Oklahoma, Louisiana, and Texas.

U. S. Steel—J. M. Haynes to manager of engine and compressor sales for the Oil Well Supply Division, with headquarters in Dallas.

Witco Chemical Co.—Joseph J. Tumpeer to senior vice-president, in charge of the Pioneer Asphalt Division.

Calumet & Hecla, Inc.—George W. Overstreet, to sales representative in North and South Carolina and in parts of Tennessee and Georgia for the Wolverine Tube Division.

Universal Controls Corp.—George Beese to plant manager, in charge of all production and purchasing.

Branches, Distributors

The Pacific Metal Co., Portland Ore., is now a distributor of Tube-Turn aluminum welding fittings and flanges. Headquarters are at 303 N. W. Park Ave. Tube-Turn is a division of National Cylinder Gas Co.

Overstreet & Kininmonth Co. have been named exclusive agents in Arizona and New Mexico for pneumatic and fluid power systems distributed in the west by the Rucker Co., of Oakland, Calif.

Suppliers

Flow Engineering Sales Co., Birmingham, Ala., has been designated distributor for the Parker Appliance Co., Cleveland.

Henry P. Thompson Co. has been appointed exclusive distributor of Gilsulate insulation for the Cincinnati area by the American Gilsonite Co.

Expansion, Transition

Girdler Corp. of Canada Ltd. headquarters have been moved to 111 Richmond St., West, Toronto.

Kaiser Steel Corp. has established a sales office at 213 N. First Ave., Phoenix, Ariz.

B-I-F Industries, Inc., Providence, R. I., has formed a Texas division with sales and service offices in Houston and Dallas. New unit is known as B-I-F Texas, Inc.

Ohio Injector Co. has licensed Sheepbridge Engineering (Canada) Ltd., Guelph, Ont., to manufacture cast steel industrial valves for distribution by the Ohio Company's marketing units in Canada.

Minneapolis-Honeywell Regulator Co. has purchased the assets of the Heiland Research Corp. of Denver, Colo., manufacturer of precision instruments. Firm will be operated as the Heiland Division.

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION

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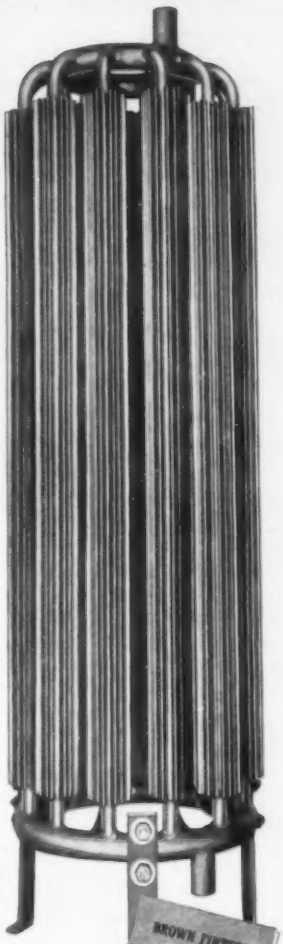

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B

Statistics and Measurement New Topics To Be Heard at API Chicago Meeting

Two features for the first time on the program of the annual meeting of the American Petroleum Institute will appear this year at the 34th annual meeting, November 8 to 11, at the Conrad Hilton Hotel and Palmer House in Chicago.

The first will be a symposium on measuring, sampling, and testing crude oil and petroleum products. This is scheduled for Monday, November 8, at 2:00 p.m. Second of the new features is a group session on petroleum statistics, which will be held Wednesday, November 10, at 2:00 p.m.

H. C. Packard, Shell Oil Co., New York, will preside over the symposium on measurement. First to be heard at this session will be J. Delbert Jones, Gulf Refining Co., Tulsa, Okla., who will deliver a paper, "95 Years of Bulk-Oil Measurement." The next address will be given by S. H. Dowdell, the British American Oil Co., Ltd., Toronto, Ont. It is titled "Present Methods of Bulk-Oil Measurement and Desired Future Improvements." J. H. McClintock, Esso Standard Oil Co., New York, will offer "A Glance into Bulk-Oil Measurement of the Future." and the final paper, "Management Looks at Bulk-Oil Measurement," will be delivered by G. H. Supple, General Petroleum Corp., Los Angeles.

The committee on petroleum statistics will have R. J. Gonzalez, Humble Oil and Refining Co., Houston, presiding. Allyn P. Evans, president of Lionel D. Edie and Co., New York, will open the meeting with an address on the "near-term" economic outlook. He will be followed at the podium by John W. Boatwright, an economist with Standard Oil Co. (Ind.), Chicago. Mr. Boatwright will take up certain economic questions affecting the petroleum industry.

The views of the Eisenhower administration will be brought to the conference in the persons of Secretary of the Interior Douglas McKay, speaking at the Wednesday morning session, and Deputy Secretary of Defense Robert B. Anderson, who will address the meeting on Thursday morning.

A session of particular interest to refinery men is that on lubrication scheduled to be held on Wednesday afternoon. Presiding will be R. Cubicciotti of L. Sonneborn Sons, Inc., New York City. Three papers make up the program: the first will be offered by B. G. Symon of Shell Oil Co., New York, and is titled "The Place of the Engineer in Petroleum Marketing." Then, P. V. Keyser, Jr., Socony-Vacuum Oil Co., New York, will address the group on "Changes and Trends in Lubrication Markets." The final speaker is to be Capt. W. C. Latrobe, supervisor of shipbuilding and naval inspector of ordnance for the United States Navy, Washington, D. C. His topic will be "Standardization Imperative to Navy Logistics."

A session on fundamental research on Monday morning will receive reports of various research projects being carried out by groups within the technical services department of the API. The Division of Refining will hold its group session Monday afternoon and a financial and accounting session is slated for Tuesday morning and afternoon.

Instrument Symposium Jan. 26-28 at Texas A. & M.

The chemical engineering department at Texas A. and M. will present again this year the symposium "Instrumentation for the Process Industries." The sessions will be held during January 26 to 28 and are to be accompanied by educational exhibits of process equipment. Emphasis is placed in these symposia on instrumentation for continuous fluid flow processes as they are used in petroleum refineries, natural gasoline and cycling plants, and some of the chemical plants found in the southwest. They are intended primarily for instrument, design, process and operating engineers.

Registration is $10 and will take place in the Memorial Student Center on the campus on January 25 and during the meeting.

Plant Maintenance Show Elects Chicago as Site

The Plant Maintenance and Engineering Show, an annual event now in its sixth year, will be held from January 24 to 27, 1955, in the International Amphitheatre in Chicago. The show will have some 188,000 sq. ft. at its disposal this year, because it will occupy a new exhibition hall in the amphitheatre. The new space will permit the holding of all general conference sessions in the arena directly adjoining the exhibit area. Clapp & Poliak, Inc., will again produce the show.

ISA Section Plans Meet On Automatic Plant

"The Automatic Plant" is the topic of a symposium to be given by the Philadelphia Section of the Instrument Society of America December 3 in Philadelphia's Commercial Museum. The symposium will be held in conjunction with the 21st National Exposition of Power and Mechanical Engineering.

Topics to be treated during the symposium include discussions of trends, applications in the power plant, engineering the control loop, and views of the automatic plant as held by management, labor, and the instrument industry.

Registration for the program will cost members of ISA and the American Society of Mechanical Engineers $2. Nonmembers will be charged $3.

Oil Man's Calendar

NOVEMBER

American Petroleum Institute, 34th annual meeting, Conrad Hilton Hotel and Palmer House, Chicago, Nov. 8-11.

Electronic Computer Clinic, 244th Regiment Armory, New York, Nov. 30-Dec. 2.

Natural Gasoline Assn. of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Texas, December 3.

DECEMBER

21st National Exposition of Power and Mechanical Engineering, sponsored by the American Society of Mechanical Engineers, Commercial Museum, Philadelphia, December 2 to 7.

"The Automatic Plant," symposium sponsored by Instrument Society of America, Philadelphia Section, Commercial Museum, Philadelphia, December 3.

American Institute of Chemical Engineers, annual meeting, New York, Dec. 12-15.

JANUARY

Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, January 24 to 27, 1955.

Instrumentation for the Process Industries, Chemical Engineering Department of Texas A. & M. College, College Station, Texas, January 26-28, 1955.

Symposium on Hydrocarbon Chemistry, Southeastern Texas Section, American Chemical Society, Houston, Texas, January 27-28, 1955.

FEBRUARY

Natural Gasoline Assn. of America, Permian Basin regional meeting, Scharbauer Hotel, Midland, Texas, February 25, 1955.

MARCH

Corrosion Conference, sponsored by the National Association of Corrosion Engineers and the University of Tennessee, at the university, Knoxville, March 1-4, 1955.

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADDITIVE, furnace oil, rust-inhibiting, samples and product data; Oronite Chemical Co. See adv't. p. 1713.

ADDITIVE, lube oil, samples and information available; DuPont Co. See adv't. p. 1766.

BUBBLE CAPS and risers, catalog 54; Pressed Steel Co. See adv't. p. 1722.

CATALYST CARRIERS made of "Alundum," bulletins 7, 140, 793; The Norton Co. See adv't. pp. 1676-1677.

CLAD STEELS, for corrosion resistant service, color movie; Lukens Steel Co. See adv't. p. 1684.

CLEANING AGENT for drums and barrels, booklet F 7629R; Oakite Products, Inc. See adv't. p. 1806.

CONDUIT, electrical, rigid, aluminum, booklet; Aluminum Co. of America. See adv't. p. 1680.

CONTROLLER, fluid flow, weather proof, bulletin 470; The Foxboro Co. See adv't. p. 1723.

ENTRAINMENT SEPARATORS, wire-mesh type, case study 1005; Otto York Co. See adv't. p. 1708.

ETHANOLAMINES, available soon, technical data and quotations; Nitrogen Div., Allied Chem. & Dye Corp. See adv't. p. 1761.

EXPANSION JOINTS, equalized, hinged, universal, bulletin 351; Zallea Brothers. See adv't. p. 1705.

FILTERS, for catalyst, to replace cyclones and electrostatic precipitators, literature; Micro Metallic Corp. See adv't. p. 1799.

FITTINGS, forged steel, screw-end and welding types, bulletin U-1; Watson-Stillman Fittings Div. See adv't. p. 1780.

FITTINGS, tube, "Swagelok," catalog; Crawford Fitting Co. See adv't. p. 1775.

FLOOR MAINTENANCE, polishers and scrubbers, explosion proof, information; Lincoln-Schlueter Floor Mach. Co. See adv't. p. 1809.

FLOW COLORIMETER, for process streams, data file 90-23; Beckman Instruments, Inc. See adv't. p. 1685.

FLUID COOLERS, bulletin DS-395; The Trane Co. See adv't. p. 1690.

INSULATION, industrial, four data books; Philip Carey Mfg. Co. See adv't. p. 1691.

LEAD for corrosion control, booklet; National Lead Co. See adv't. p. 1694.

MATERIAL HANDLING, "Truckster," for light hauling, booklet; Cushman Motor Works, Inc. See adv't. p. 1795.

MIXERS, side and top entering, nine catalogs available; Mixing Equipment Co. See adv't. p. 1724.

MIXERS, various types cover most applications, catalog series 19; Eastern Industries, Inc. See adv't. p. 1807.

MOTOR STARTERS, for hazardous locations, booklet 1062; Electric Controller & Mfg. Co. See adv't. p. 1721.

PACKINGS, for pumps and valves, "Teflon," bulletin TP-1053; U. S. Gasket Co. See adv't. p. 1810.

PIPE CUTTER, hinged, for steel and cast iron pipe, literature; Reed Mfg. Co. See adv't. p. 1803.

PIPE ELBOWS, "Long Tangent," catalog 54; Midwest Piping Co., Inc. See adv't. p. 1792.

PIPE, fittings and valves, "Saran-Lined," corrosion resistant, catalog; Saran Lined Pipe Co. See adv't. p. 1794.

PLASTIC, "Tygon," many uses as pipe, tubes, paint, etc., portfolio available; U. S. Stoneware Co. See adv't. p. 1675.

PRESSURE TRANSMITTER, shiftable range, bulletin 98097; Taylor Instrument Cos. See adv't. p. 1696.

PROCESS ENGINEERING, case history brochure 103; Kaiser Engineers. See adv't. p. 1668.

PUMPS, centrifugal, many types and styles, bulletin P-3a; Ampco Metal, Inc. See adv't. pp. 1692-1693.

PUMPS, proportioning, for small volume flows, catalog UP-54; Hills-McCanna Co. See adv't. p. 1797.

PUMPS, stuffingboxless, high pressure service, bulletin 107. Bingham Pump Co. See adv't. p. 1706.

RECORDERS, chart, three types, literature; Fielden Instrument Div. See adv't. p. 1801.

REFINERY EQUIPMENT, Bulletin E-1; Henry Vogt Machine Co. See adv't. p. 1697.

REFRACTORY LININGS, hydraulic setting, brochure RC-28A; Johns-Manville Corp. See adv't. p. 1793.

STEEL FABRICATION, for refineries, general catalog; Flint Steel Corp. See adv't. p. 1805.

STEEL, glassed and stainless, fabricated, bulletins 914 and 837; The Pfaudler Co. See adv't. p. 1754.

STEEL, stainless, for refinery service, performance booklet available; U. S. Steel Corp. See adv't. p. 1707.

STRAIN GAGE, "Teledyne," for remote applications, literature; Taber Instrument Corp. See adv't. p. 1764.

STEAM TRAPS, five types, catalog 953; W. H. Nicholson & Co. See adv't. p. 1665.

SULFUR-DIOXIDE, available in various quantities, samples and specifications; Tennessee Corp. See adv't. p. 1795.

SWING JOINTS, steel, many sizes and styles, catalog 400; Barco Mfg. Co. See adv't. p. 1769.

TANK GAUGE, electronic, brochure; Gilbert & Barker Mfg. Co. See adv't. p. 1674.

TANK HEATERS, vertical mounting, bulletin 541; Brown Fintube Co. See adv't. p. 1779.

THERMOMETERS, dial, bulletin 350; Palmer Thermometers, Inc. See adv't. p. 1807.

TUBE CUTTER, internal, for removing damaged tubes, literature; Airetool Mfg. Co. See adv't. p. 1667.

TUBES, condenser, available in several metals, booklet; Wolverine Tube Div. See adv't. p. 1656.

VALVE POSITIONER, for dampers and slide valves, bulletin 1-86; Askania Regulator Co. See adv't. p. 1799.

VALVES, gate forged steel, folder 195; Ohio Injector Co. See adv't. p. 1700.

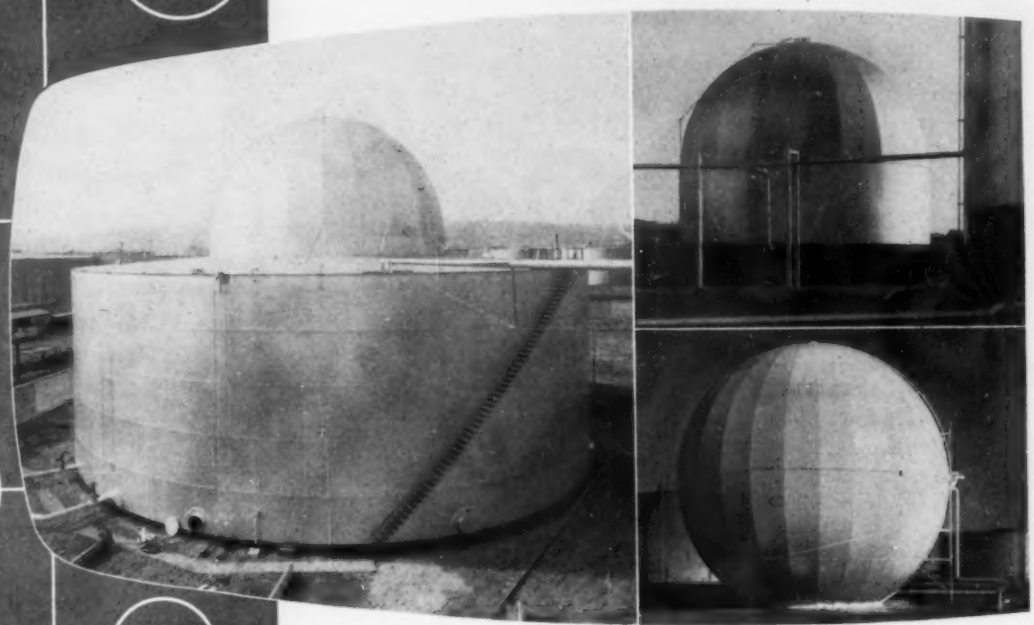
VALVES, lubricated plug, reference book 39-5; Homestead Valve Mfg. Co. See adv't. p. 1813.

VALVES, small sizes, needle and toggle types, catalog and data sheets: Hoke, Inc. See adv't. p. 1789.

VALVES, steel, dry plug, various types. catalog; Wedgeplug Valve Co. See adv't. p. 1796.

It takes a System to Conserve Vapor

Below: A 25,000-cu. ft. Horton Vaportank. An independent vapor storage unit interconnected to one or more tanks.



Above: 80,000-bbl. tank equipped with a Hortondome Roof. It may be interconnected to the vapor spaces of adjacent tanks to form a vapor conservation system.

Above: 150,000-cu. ft. Horton Vaporsphere. This is an independent vapor storage unit of spherical design operating the same as the Vaportank.

Vapor conservation is of prime importance to anyone storing volatile hydrocarbons in fixed roof tanks. Saving vapor is like saving money because it's actually *profits* that evaporate.

A Horton® vapor conservation system has a Hortondome® Roof, Vaporsphere® or Vaportank® as a central storage unit connected by piping to the vapor spaces of one or more gastight tanks. Vapor forced from the tanks is stored in the central unit under a flexible, hemispherical membrane until conditions causing the displacement are reversed.

Information, estimates or quotations on a vapor saving system may be obtained by writing our nearest office.

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Boston 10 ..... 1029—201 Devonshire Street
Chicago 4 ..... 2114 McCormick Building
Cleveland 15 ..... 2215 Midland Building
Detroit 26 ..... 1532 Lafayette Building
Houston 2 ..... 2130 C&I Life Building
Los Angeles 17 ..... 1526 General Petroleum Building
New York 6 ..... 3310—165 Broadway Building
Philadelphia 3 ..... 1630—1700 Walnut St. Building
Pittsburgh 19 ..... 3236 Alcoa Building
Salt Lake City 4 ..... 530 West 17th South Street
San Francisco 4 ..... 1559—200 Bush Street
Seattle 1 ..... 1330 Henry Building
Tulsa 3 ..... 1620 Hunt Building

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Horton Steel Works Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comprimo, N. V., 21, Amstel, Amsterdam (C) Netherlands
Sociedade Chibridge de Construcoes Avenida General Justo, 275, Grupo 306, Rio de Janeiro, Brazil

 (To obtain more data on advertised products see page 1784)

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

•

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

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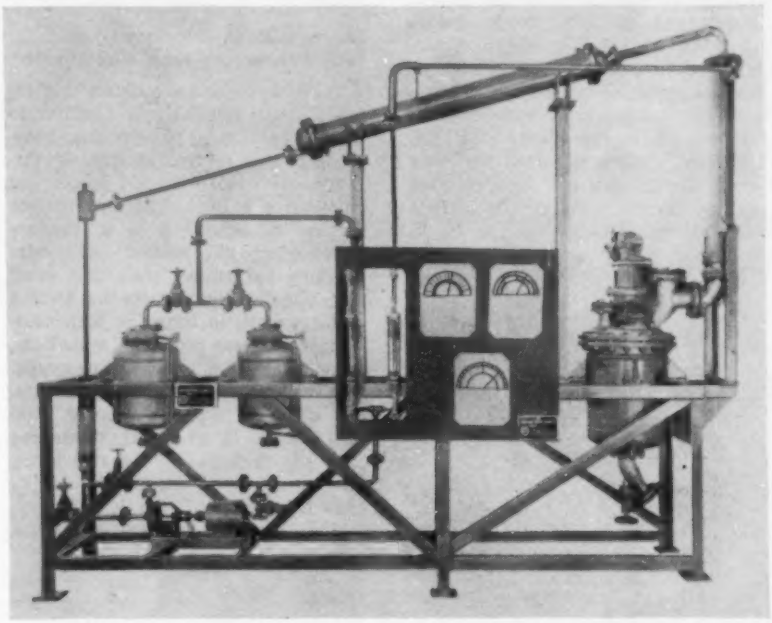
WHAT'S NEW . . .



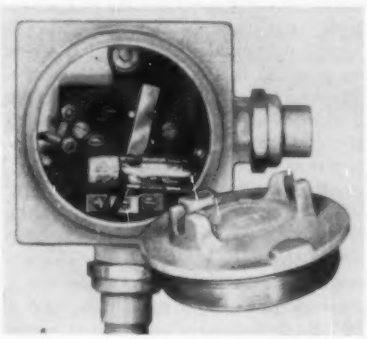
New Compact Pilot Unit Flexible

This new, semi-pilot plant assembly unit is compact, requiring less than 55 sq. ft. of floor space and 12 ft. of height. An experimental unit, it is applicable to the study of different processes for obtaining basic design data, determining effects of variables, and evaluating the practical economics of the processes. The "I-P-E" unit comes preassembled, or in match-marked parts for simple installation. Maintenance and operation are claimed to be easy, and control precise. The assembly consists of a jacketed reaction vessel with flush bottom valve, and a variable speed drive agitator with interchangeable impellers; a jacketed column suitable for packing; a shell-and-tube condenser; a condensate pump; two 15 gal. receivers; and a panel for control and measurement of product and reflux rates suitable for installation of temperature and pressure controllers. Industrial Process Engineers, 8 Lister Ave., Newark 5, N.J.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the number corresponding to the number at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



Vibration-and-Safety Switch Prevents Cooling Tower Damage

. . . resulting from blade breakage and equilibrium loss on fans. A mercury switch with adjustable sensitivity automatically stops a fan's electric current when vibration becomes excessive. Manual resetting of the switch is required to restart the fan, protecting maintenance personnel from injury by preventing accidental resetting of the switch by vibration. The "Dual-Safety" switch is operated remotely, not requiring entrance into the fan stack for resetting. Santa Fe Tank & Tower Co., Inc., 5401 S. Boyle Ave., Los Angeles 58, Calif.

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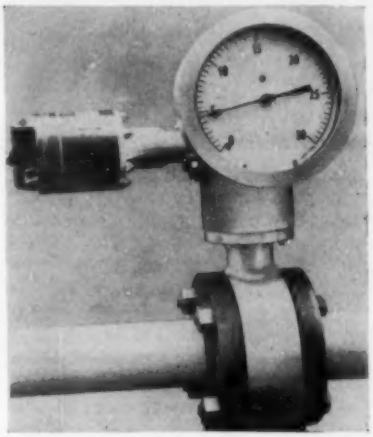

Variable-Area Flow Meter Measures Gas or Liquid Flow

. . . for corrosive and non-corrosive systems. The in-line construction is pocket-free, permitting passage of solids in suspension, slurries, and sludges. The meter design combines the installation simplicity of the differential orifice with the linear measurement signal, wide range, and low viscosity sensitivity of variable-area type meters. The yoke is provided with a mounting pad for field or factory attachment of micro-switches, pneumatic or electrical position transmitters, or local controllers. Supplied for installation in pipe lines from ½ in. to 12 in., the meter handles flow rates of from 0.2 to 2,000 gpm liquid, from 10 to 60,000 lb./hr. steam, or from 1 to 6,000 cfm gas. The meter may be installed at any convenient angle. An essentially constant pressure drop through the entire flow range, as the area of the meter insert varies directly with flow rate, gives a linear measurement. Total available rangeability of each metering insert is 1 to 35. Construction may be of almost any metallic or non-metallic material except glass and other unmachineables. Devicengineering Co., 1701 Walnut St., Philadelphia 3, Pa.

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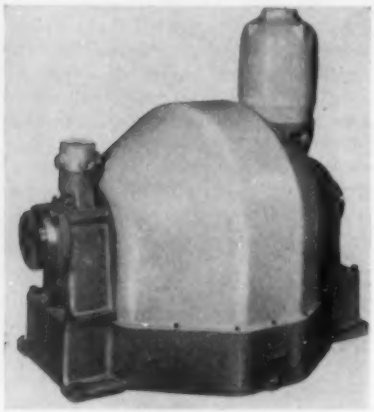


New Gyro Basis Flow Meter Reads Mass Flow Directly

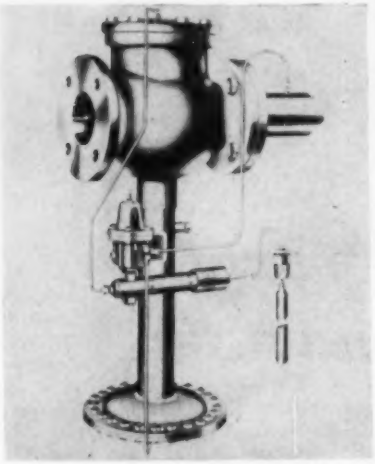
. . . for fluid streams. The operating principle of the "Gyro Mass Meter" makes flow measurement fundamentally independent of temperature, pressure, viscosity, or volumetric flow rate. Reading directly in pounds, it facilitates more accurate flow cost-accounting methods. The principle of the gyroscope is used by sending the fluid through a pipe coil so that the fluid has an angular momentum similar to the wheel of a conventional gyroscope. The pipe coil is spring-restrained, and flow through it produces a torque which is converted to AC voltage, which is directly proportional to the mass flow rate, by an electromagnetic signal generator. Controls Division, Control Engineering Corp., 934 Washington St., Norwood, Mass.

Circle No. **4** *on Reply Card*

Explosion-Proof Light Safe For Hydrogen Atmospheres

. . . and is claimed to be the first and only unit approved by the Underwriters' Laboratories for use in hydrogen areas. The lights operate with a self-contained air pressure which eliminates breathing and seepage of gases which can cause interior explosions. These lights have been specified as required equipment for hydrofiners and platformers, and many major oil companies have specified or are specifying these lighting units for all hydrogen and other highly hazardous locations, according to the manufacturer. "Air Pressure" lights have an internal operating pressure of 15 psi, and will automatically extinguish if internal pressure drops to 3½ psi. Units can be repressurized and new relief devices inserted by operating personnel. Safe Lighting Inc., 91-03 Astoria Blvd., Jackson Heights, N. Y.

Circle No. **5** *on Reply Card*



Single Valve Controls Both Pressure and Temperature

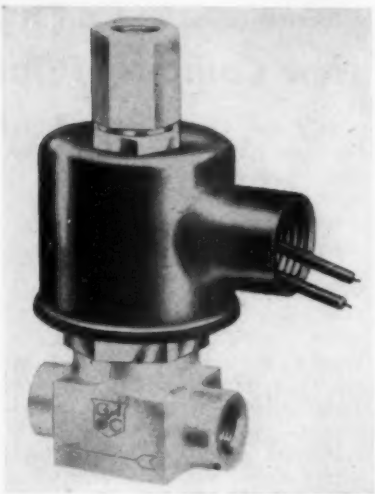
. . . simultaneously. Designed to prevent the hunting, cycling or over-heating sometimes occurring with a temperature control alone, it is known as "No. 1649". The valve is set for the maximum pressure demand of the system. The downstream pressure is sensed by the pilot valve which opens or closes to maintain this set pressure. This action is supplemented by the temperature control pilot valve which shuts the main valve when the temperature control point is reached, regardless of the downstream pressure. When the control temperature falls below the set point, the main valve opens and the pressure controller resumes automatically. Available for a pressure range of 5 to 125 lb., and a 50° F. temperature adjustment range covering 25° F. to 275° F. in a series of six valves. Construction is of semi-steel bodies for 2 in. and over, smaller sizes having bronze bodies. For 4 in. and smaller, stainless steel trim is used, and larger sizes have bronze trim, but can be supplied with stainless. Eight feet of capillary tubing and a nickel plated bulb are standard on all sizes. Klipfel Valves, Inc., Hamilton, Ohio.

Circle No. **6** *on Reply Card*

Surface Rust Is Converted Into Protective Iron Phosphate

. . . by application of liquid "FerRo-Seal" to the rusted areas. Claimed to be the only cold phosphating treatment known for rusted iron, it furnishes a suitable base for subsequent painting or coating. The only surface preparation needed prior to the application of "FerRoSeal" is a wire brushing to remove scale and loose rust. The distributor states that treated surfaces work in harmony with coatings of coal tar products, asphaltum, gilsonite, vinyls, silicons, neoprene, zinc base materials, paints and others. One gallon of liquid will cover 1000 to 1500 sq. ft. of metal, depending upon the thickness of the rust layer. Municipal Steel Corp., Chemical Div., 1225 Bdwy., New York 1, N.Y.

Circle No. **7** *on Reply Card*



Midget 3-Way Magnetic Valve Handles Gas and Liquid Flow

. . . with an axial flow outlet. It can be furnished as a normally closed 3-way, normally open 3-way, or as a directional flow control valve. The "K-273" has a rotatable solenoid cover for installation ease, and is available with brass or stainless steel body. The manufacturer claims quiet operation and a soft valve seat assuring 100% shut-off. Its small size lends it to installation in crowded areas or as a machinery component. General Controls Co., Glendale, Calif.

Circle No. **8** *on Reply Card*

Only the Wiggins Gasholder*

has the dry fabric seal that

eliminates maintenance problems!

Write for information

WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street
Chicago 90, Illinois

*PATENTED

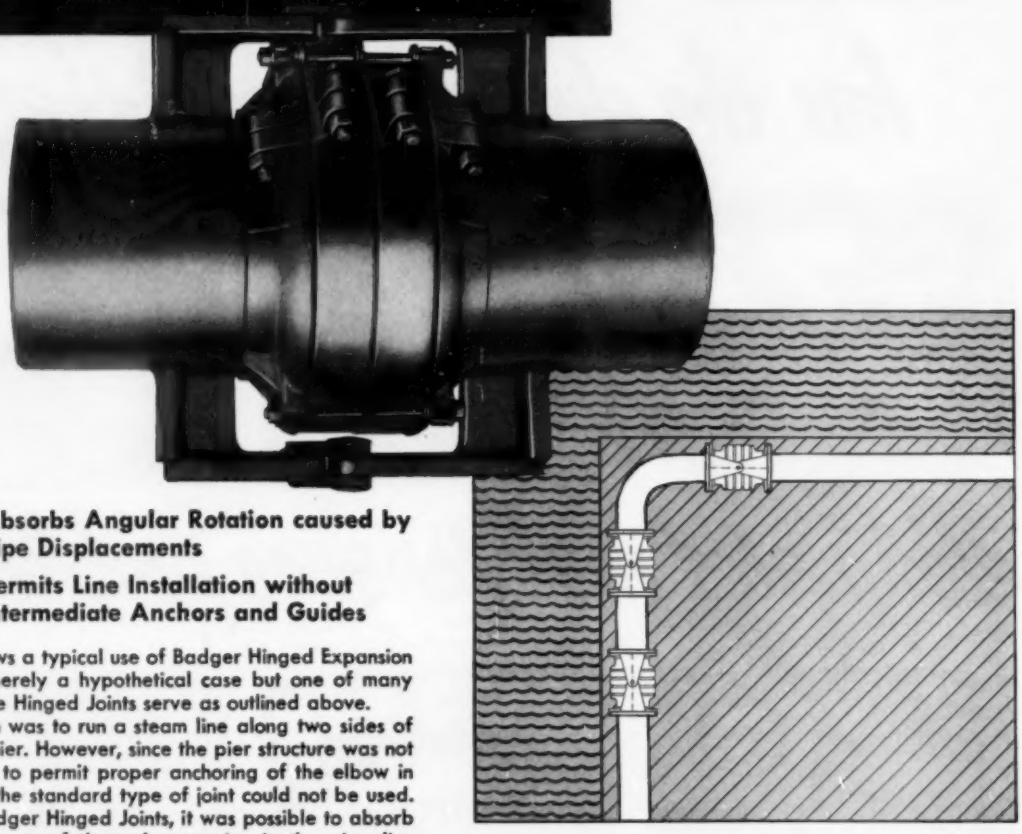
 (To obtain more data on advertised products see page 1784)

BADGER

EXPANSION JOINTS

Typifying Joint Engineering at its Best

THE *Hinged* EXPANSION JOINT



- **Absorbs Angular Rotation caused by Pipe Displacements**
- **Permits Line Installation without Intermediate Anchors and Guides**

The sketch shows a typical use of Badger Hinged Expansion Joints . . . not merely a hypothetical case but one of many instances where Hinged Joints serve as outlined above.

The problem was to run a steam line along two sides of a waterfront pier. However, since the pier structure was not strong enough to permit proper anchoring of the elbow in the pipe line, the standard type of joint could not be used. With these Badger Hinged Joints, it was possible to absorb the large amounts of thermal expansion in the pipe line without the need for an intermediate anchor.

Hinged Joints must always be used in groups of two or more. Three such joints give a maximum of flexibility while reducing to a minimum the thrust on the end anchors.

The Hinged Joint is but one of several special Badger Expansion Joints designed for unusual conditions. Why not outline *your* proposed pipe line installations to our engineering department? We can serve you whether special or conventional type expansion joints are needed. And back of our service is some sixty years of experience.

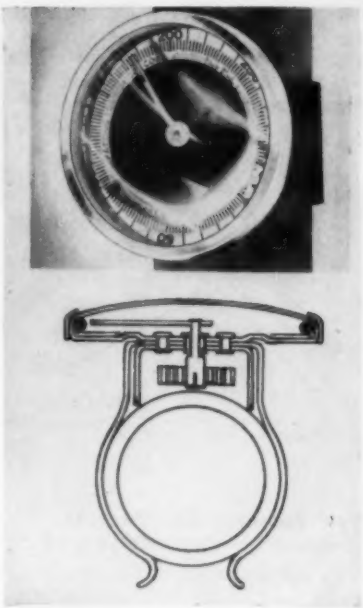
Badger Expansion Joints come in a variety of types and a wide range of sizes: Directed Flexing, Self-Equalizing for longer traverses and higher pressure; Non-Equalizing, for shorter traverse and when pressures are low; Tandem Joints for combination axial and lateral movements; Clevis or Hinged Joints for angular rotation.

Corrugated Flexible Connectors; Flexible Pipe Line Seals for watertight connection between pipe and flood walls.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE 41, MASS.



Surface Thermometer Attached To Pipe by Spring Clip

. . . without the use of tools. The "Pipe Surface Thermometer" can be used to obtain skin temperatures of pipes and tubes from ½ to 2 in. diameter. The calibrated bimetal temperature sensitive element is closely coupled to the pipe, giving an accuracy of ± 2° F. over the entire thermometer range, and reaching stability within 5 minutes. The thermometer comes in two ranges, —50° F. to +250° F., and +70° F. to +370° F., with a 2 in. diameter dial. The Pacific Transducer Corp., 11836 W. Pico Blvd., Los Angeles 64, Calif.

Circle No. **9** *on Reply Card*

Plastic Insulating Spray Gives Electric or Corrosion Protection

. . . providing a coat 0.75 mils thick with one spray stroke. Repeated application will build the film to any desired thickness. The resulting air-drying film finish is tough and flexible, having a dielectric strength of 800 to 1200 volts per mil. Suggested uses include coating of plant and equipment surface as spot protection against corrosion, and electrical insulation for buss bars, transformer and coil leads, motor coil leads, motor coils, switchgear, starters, and controllers. It will moisture-proof terminal boards and permanent electrial connections. Available clear and in colors, "E-26" coating may be applied by dip and brush as well as by spray. Delivery is in 12 oz. push but-

HOKE

Flow Sheet

Hoke reports on fluid control

scientific nose

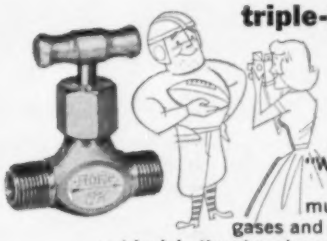
Motorists in vehicular tunnels throughout the nation may owe their lives—or at least their comfort—to Carbon Monoxide Detection Equipment manufactured by Taller & Cooper, Inc., of Brooklyn, N. Y. Says Stanley A. Kroll, vice-president, "We have always specified Hoke Toggle Valves for our equipment because of the close tolerances to which Hoke products are made. Once a Hoke Valve is placed in the line, no maintenance is required."

If you have a similar toggle valve application, we'll be glad to send you catalog and data sheets, pronto.

water—pure and simple

Pure, demineralized water—whenever you want it. That's the purpose of the Barnstead Pressure Bantam Water Demineralizer, a product of Barnstead Still and Sterilizer Co., of Boston, Mass. An important part of this equipment is a Hoke Needle Valve, chosen because of "its compact size and its precise flow regulation characteristics." Hoke Needle Valves come in sizes ⅛" to ½" in aluminum, brass and stainless steel.

triple-threat valve



"We tested many valves for our Infra-Red Gas Analyzer before selecting Hoke," says Max D. Liston, of Liston-Becker Instrument Co. "We had three requirements in mind. First, the valve must withstand corrosive gases and environments; second, it must not leak in the closed position, holding a charge for as long as a year; third, it must fit into a very limited space. So far, Hoke Valves have met all requirements."

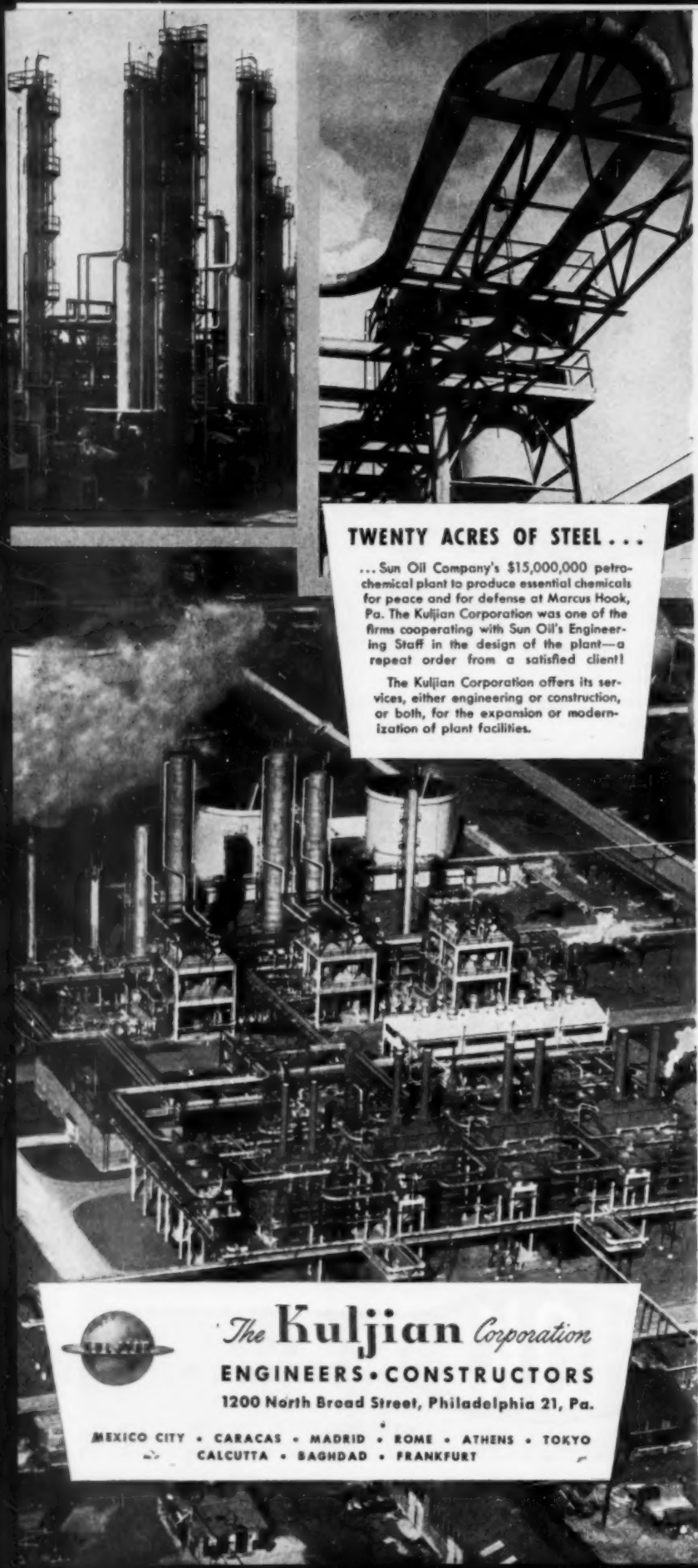
Do you have a tough job for a small valve? Why not let us offer our suggestions?

HOKE

HOKE INCORPORATED

Fluid Control Specialists

161 S. DEAN STREET, ENGLEWOOD, N. J.



TWENTY ACRES OF STEEL . . .

. . . Sun Oil Company's $15,000,000 petrochemical plant to produce essential chemicals for peace and for defense at Marcus Hook, Pa. The Kuljian Corporation was one of the firms cooperating with Sun Oil's Engineering Staff in the design of the plant—a repeat order from a satisfied client!

The Kuljian Corporation offers its services, either engineering or construction, or both, for the expansion or modernization of plant facilities.

The **Kuljian** *Corporation*

ENGINEERS • CONSTRUCTORS

1200 North Broad Street, Philadelphia 21, Pa.

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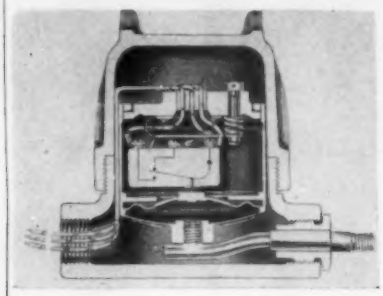
ton sprayers, or by bulk for large amounts. Information and test data available on letterhead request to the Insl-X Sales Co., 26 Rittenhouse Place, Ardmore, Pa.

Do Not Use Reply Card



New Pressure and Vacuum Switches Are Explosion-Proof

. . . and are claimed to repeat to within ±1% of their setting. Approved by Underwriters' Laboratories for atmospheres containing vapors of ethyl, ether, gasoline, alcohol, acetone, petroleum, naphtha, lacquer solvents, natural gas or grain dust, the line covers a range from 30 in. Hg. vacuum to 150 psi. Standard models are available with single or double settings—the latter will actuate two electrically independent circuits of AC and/or DC current. The units reset automatically by the snap action design of the switches. Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.

Circle No. **10** *on Reply Card*

Heat Transfer Cement Is Cheaper Than Jacketing

. . . for traced process lines, valves, and equipment where it is desirable to maintain a constant temperature by the addition or subtraction of heat. "Tracit" is a mixture of powders and a liquid forming a mortar-like material which is self-hardening, and claimed to be highly resistant to mechanical and thermal shock. It is adhesive, and easily applied to surfaces by hand or a trowel. Especially useful for irregular shapes difficult to jacket by conventional methods, it has favorable heat transfer characteristics and compressive strength. The manufacturer recommends "Tracit" for floors of radiant-heated plants where good heat distribution is desired in the tubing. Chemax Manufacturing Corp., 900 Wilmington Rd., New Castle, Del.

Circle No. **11** *on Reply Card*

When the Sun bears down . . .

HOW WELL DOES YOUR MOTOR FUEL STAY IN THE USER'S TANK?

Blending with WARREN NATURAL GASOLINE will give it . . .

"RETAINED VOLATILITY"

You can depend on WARREN'S Production, Storage and Transportation Facilities for delivery of the Quality and Quantity of Natural Gasoline you need . . . when and where you want it!

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

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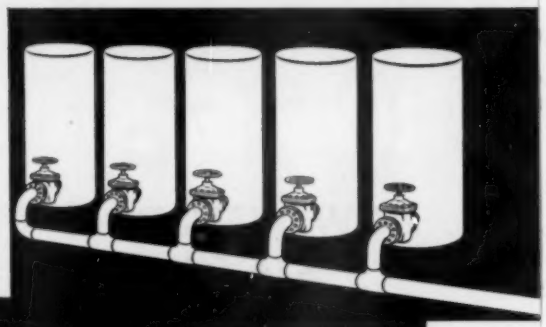
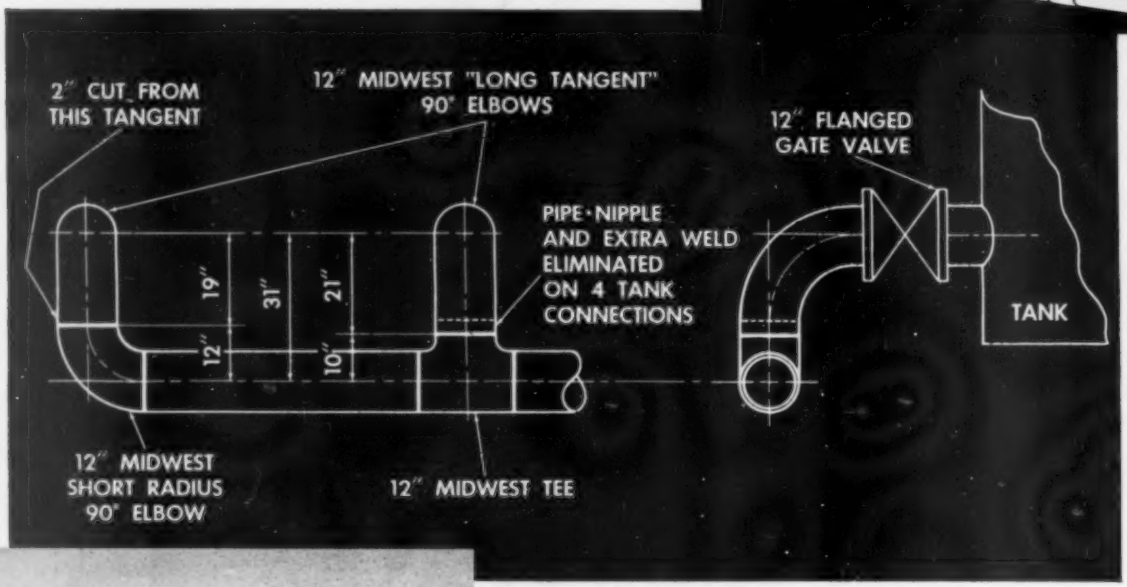
MIDWEST "LONG TANGENT" ELBOWS

SAVED $156.20

On This Welding Piping





MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

The Problem:

To connect the five tanks shown in the sketch at top to a common 12" header.

The Difficulty:

The center-to-outlet dimension of the 4—12" tees is only 10", while the shortest elbow available measures 12" center-to-end. Thus, if standard long radius elbows are used next to the five tank valves, four short nipples and four extra 12" welds would be required.

The Solution:

By using Midwest "Long Tangent" elbows as shown in the blueprint, the expense of the four extra nipples and welds was eliminated at the cost of just one cut! The actual net savings made by "Long Tangent" elbows on this job was $156.20.

Remember—Midwest "Long Tangent" elbows cost no more than regular elbows! For further information, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.

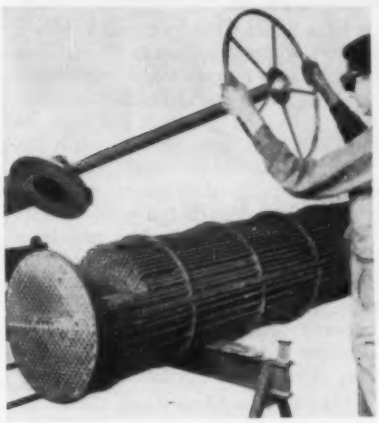
Main Office, 1450 South Second St., St. Louis 4, Missouri

PLANTS: ST. LOUIS, PASSAIC, LOS ANGELES, and BOSTON

SALES OFFICES: NEW YORK 7—50 CHURCH ST. • LOS ANGELES 33—520 ANDERSON ST.
BOSTON 27—426 FIRST ST. • CHICAGO 3—79 WEST MONROE ST.
CLEVELAND 14—616 ST. CLAIR AVE. • HOUSTON 2—1213 CAPITOL AVE.
TULSA 3—224 WRIGHT BLDG.

6820

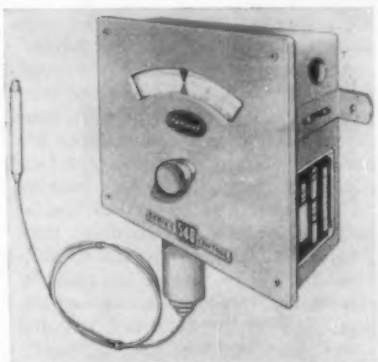
MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



Bundle Slicer Speeds Retubing Of Condensers and Exchangers

. . . and consist of an abrasive cut-off wheel mounted on a long movable arm. It is claimed that one man using the "Ohmstede Bundle Slicer" can cut a bundle in an hour and a half where conventional methods require two men one or more days. The cutting wheel is of reinforced resinoid. Tubes are cut cleanly, without burrs facilitating knocking the cut-off ends out of the tube sheet prior to retubing. Powered by a 7½ HP totally enclosed motor, the cutter is primarily designed for non-ferrous tubes, but works equally well on steel tubing. Norton Co., Worcester 6, Mass.

Circle No. **12** *on Reply Card*



Temperature-Control Indicator Has Accuracy to Within 1%

. . . of full scale under most conditions, and at low cost. A compact remote operating instrument designed for ovens, packaging and processing equipment of all kinds, the "Series 540" has a temperature range of 100° to 700° F. with uniform sensitivity. It may be flush or surface mounted. Operation

J-M BLAZECRETE cuts refractory maintenance costs...

That's why it pays you to use this hydraulic-setting refractory for temperatures to 3000F

Blazecrete* materially reduces labor costs for refractory maintenance. This hydraulic-setting refractory saves time in building and repairing linings for high-temperature equipment.

For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place. When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast, without laborious ramming or tamping. And Blazecrete linings *last.*

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix—can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic-setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U.S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

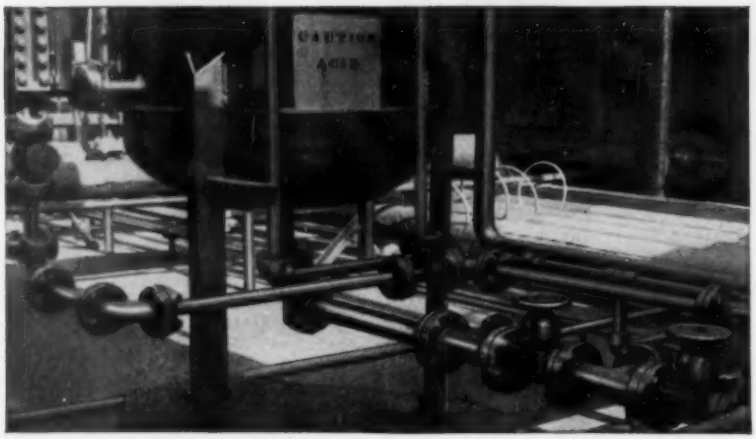
Johns-Manville **BLAZECRETE**

BUILDS BETTER REFRACTORY LININGS

DOW

CORROSIVE FERRIC CHLORIDE FLOWS THROUGH THIS SARAN LINED INSTALLATION

Large West Coast refinery depends on easy-to-install SARAN LINED STEEL PIPE to resist corrosion and assure uninterrupted processing



Some time ago, a large West Coast oil company investigated better methods to handle corrosive ferric chloride solution. The company's successful operation demands uninterrupted processing. Unscheduled "shut-downs" mean production pile-ups, layoffs and heavy expense. Saran lined steel pipe was successful from the start. The use of saran lined pipe, fittings and valves assured tight, leak-proof joints. The dependable, long-term service and excellent corrosion resistance of strong, rigid saran lined pipe will postpone replacements indefinitely. Saran lined steel pipe can be delivered immediately, cut and threaded to your specifications or fabricated in the field with your own equipment. We'll be glad to assist you with installation plans. THE DOW CHEMICAL COMPANY, Midland, Mich.

RELATED SARAN PRODUCTS

Saran rubber tank lining • Saran rubber molding stock • Saran pipe and fittings • Saran tubing and fittings

Saran Lined Pipe Company
2415 Burdette Ave., Ferndale, Mich.

Please send me a copy of your catalog on saran lined pipe, valves and fittings.

Name_____

Title_____

Company_____

Address_____

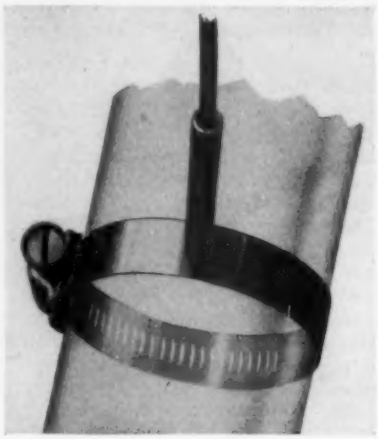
City_____ State_____

SP 1167G-1

you can depend on DOW PLASTICS DOW

is by a liquid-filled bulb and capillary system whose response is transmitted to a bellows assembly and mechanical linkage with an indicating pointer. Spring loading prevents backlash in the linkage points. The control set-point establishes the "on" point, and the adjustable differential setting—from 0.8 to 4% of full scale—determines the "off" point. The unit may be exposed to —65° F. without damage, and the bellows is self-compensating for ambient temperature changes between 50° and 150° F. The case is about 6-¾ in. square by 2-¾ in. deep. Fenwal Inc., Ashland, Mass.

Circle No. **13** *on Reply Card*



Thermocouple for Pipe Surface Has Adjustable Pipe Clamp

. . . made of stainless steel with steel spring protecting the thermocouple terminal in the clamp. Recommended for reading outside pipe temperatures whenever immersion thermocouples are undesirable, lines are not easily entered, or process flow cannot be interrupted; also for checking other temperature devices or insulation effectiveness, and obtaining temperature gradients by the use of multiple units. The unit is installed by placing the opened clamp around the pipe, slipping the band end into the worm gear housing, and tightening with a screw driver. The 20 gauge thermocouple lead wire is 18 ft. long, protected by silicone - impregnated, glass over asbestos, waterproof insulation. Thermocouples come as copper-constantan for low temperatures or iron-constantan for temperatures up to 1000° F. Clamps are available for pipe sizes from ⅜-in. I.P.S. through 4 in. I.P.S. Conax Corp. 4515 Main St., Buffalo 21, N. Y.

Circle No. **14** *on Reply Card*

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.

Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE RECORDERS

NOW! SHAFT DRIVE POWER in LIGHT hauling!

TOTAL OPERATING COST 3/4¢ PER MILE

- EXTRA POWER
- EXTRA CAPACITY
- EXTRA ECONOMY

Slash inner plant handling and delivery costs as have hundreds of other plants. Put Cushman 780 TRUCKSTERS on your jobs—NEW this year with SHAFT DRIVE. Complete with 3 speeds forward, one reverse. Get the EXTRA power advantages of big vehicle shaft drive—plus quick, easy handling AND low operating cost—less than a penny a mile. With capacity up to 500 pounds, TRUCKSTER can speed up hundreds of handling jobs for you!

Cushman

780 SHAFT DRIVE TRUCKSTER

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- See Your Nearest Cushman Dealer for FREE demonstration

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967 No. 21st St.
Lincoln, Nebraska

SULPHUR-DIOXIDE
HIGHEST QUALITY
SO_2

May Put Your DUCKS IN A ROW!

Many industries with vision have lined up their problems with **Tennessee Corporation Sulphur-Dioxide.** In most cases a more advantageous and economical operation has been achieved through the use of this chemical (SO_2) with its extreme versatility. We can supply **Tennessee's** fine quality **Sulphur-Dioxide** in any desired quantities. Perhaps you have a specific process in which **Tennessee Sulphur-Dioxide** may increase your plant efficiency. Let our own technical experts advise you by writing for details.

CONTAINERS
- Cylinders
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Samples, Specifications and Detailed Information on Request.

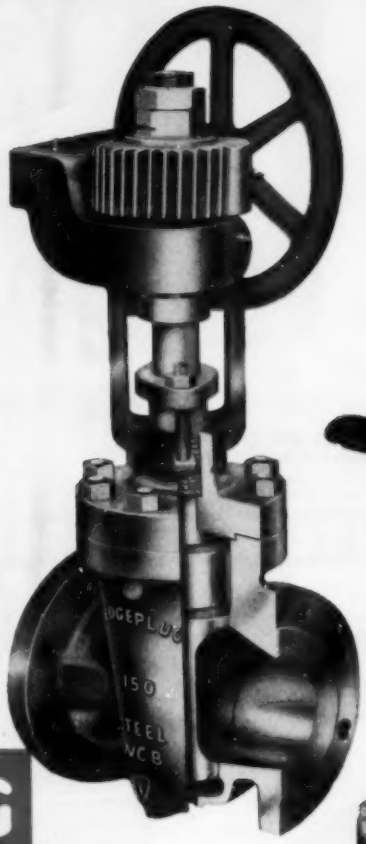
TENNESSEE TC CORPORATION
617-629 Grant Building, Atlanta, Ga.

DEPENDABLE

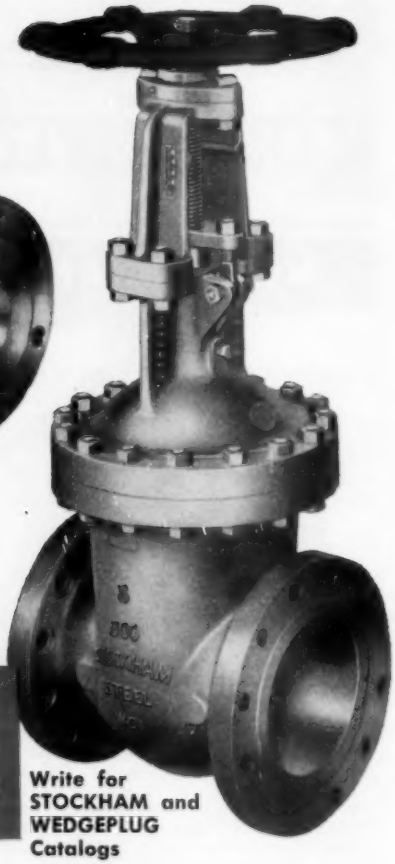
•at HIGH TEMPERATURE

•at LOW TEMPERATURE

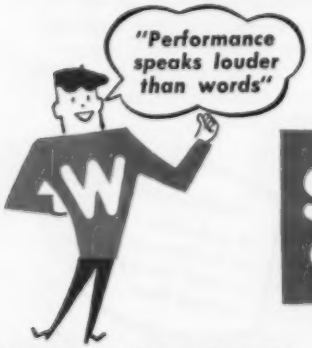
WEDGEPLUG Steel Dry Plug Valves that need no lubricant and STOCKHAM Cast Steel Gate Valves both meet the exacting requirements of the Petroleum, Petro-Chemical, and Chemical Industries. For more than a half-century, the Stockham Organization has been recognized for the dependability of its products.



"KNOW HOW" ASSURES THEIR GOOD PERFORMANCE



WEDGEPLUG
STEEL DRY PLUG VALVES



STOCKHAM
CAST STEEL GATE VALVES

Write for STOCKHAM and WEDGEPLUG Catalogs

WEDGEPLUG VALVE COMPANY, INC.
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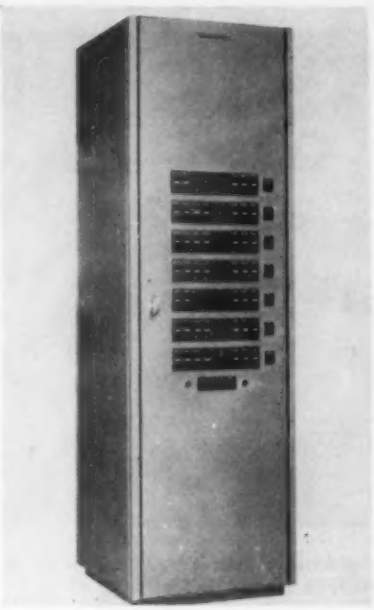
An Affiliate of
STOCKHAM VALVES & FITTINGS
GENERAL OFFICES AND PLANT, BIRMINGHAM 2, ALA.

STEEL DRY PLUG VALVES • CAST STEEL GATE VALVES
BRONZE VALVES • IRON BODY VALVES • PIPE FITTINGS
Distributed Through Wholesalers
WAREHOUSE STOCKS CONVENIENTLY LOCATED

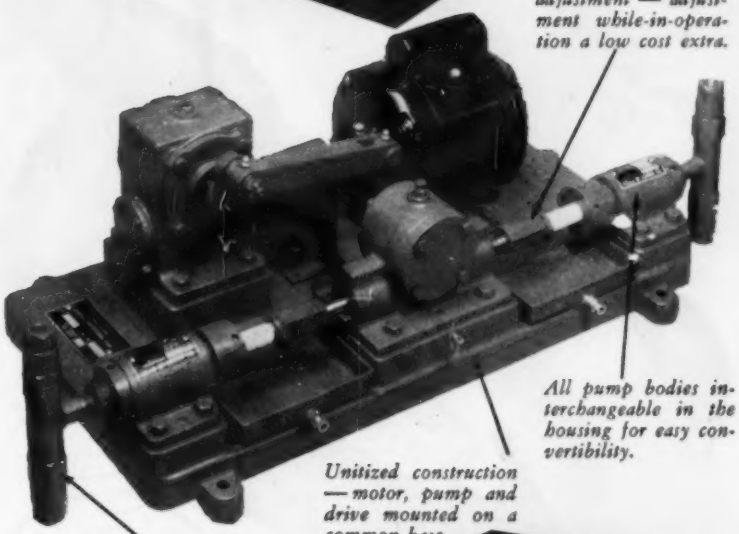


Remote Control Apparatus Is Operated by Radio or Wire

. . . and is suited for operations over long distances where multi-conductor cable installation and maintenance costs are prohibitive. For use with any type of communications equipment capable of carrying audio signals, it can be applied for remote operation of booster station pumps, valves and valve controllers, alarm functions, level supervision of storage and separator tanks and other refinery and gathering operations. Errors are reduced by the two-step "select-before-operate" sequence. After the selection button has been pressed a two-frequency tone coded signal transmits to the remote location to verify the actual setting of the remote device, returning a confirming signal to the master control panel. "Unauthorized" changes in the remote device setting automatically actuate alarm signals. Any number of remote devices may be operated simultaneously by a master operate key. Transmission media noises are negated by using specific audio tones in a coded sequence which are controlled to within narrow limits of accuracy, or operation is prevented. One controller can handle up to 90 individual points by using 12 different tones. A multi-terminal system is possible with one master console controlling up to ten remote stations. Motorola Communications and Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill.

Circle No. **15** *on Reply Card*

Can your proportioning pumps match this for convenience and versatility?


Easy, precise stroke adjustment — adjustment while-in-operation a low cost extra.
All pump bodies interchangeable in the housing for easy convertibility.
Unitized construction — motor, pump and drive mounted on a common base.
Separate, interchangeable external check valves for easy dismantling or replacement.

HILLS-McCANNA "U" TYPE PROPORTIONING PUMPS

Hills-McCanna "U" Type Proportioning pumps combine precision operation with high standards of convenience and versatility not ordinarily associated with pumps of this type. The "U" pump is easy to install and can be converted quickly and economically for changing service requirements.

If you must continuously meter or proportion small volume flows with great accuracy, it will pay you to consider a Hills-McCanna "U" Type Pump. Capacities range from 0.10 to 24 gph per feed, 1, 2, 3 and 4 feed units are available.

Write for Catalog UP-54. HILLS-McCANNA CO., 2441 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM SAND ALLOY CASTINGS

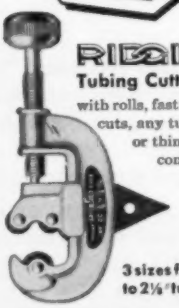
For Easiest Pipe Cutting ...it's a heavy-duty RIDGID

6 sizes:
⅛" to 6"—
4-wheel cutters
to 4"

Every RIDGID Pipe Cutter TESTED for perfect tracking before shipment

Cut more pipe with less work with RIDGID

Once you've put a RIDGID Cutter on a pipe and seen how easily and cleanly it rolls through the metal, you won't want any other kind. Smartly balanced for easy action. Tracks perfectly—and special warp-proof malleable housing keeps it that way. High alloy thin-blade or heavy-duty cutter wheels, practically no burr. For fast cutting with least effort, ask your Supply House for a RIDGID.



RIDGID Tubing Cutter with rolls, fast easy cuts, any tubing or thin wall conduit.

3 sizes for ⅛" to 2⅛" tubing

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

What's New!

Automatic Titrimeter Halves Titration Time

. . . during mass titrations. Titration data can be obtained in about one minute compared to 2 or 3 for manual operations. A fraction of a drop of 0.001 N sodium hydroxide solution is ample to activate the controlling electronic indicator eye. The entire automatic section of the instrument is offered separately and can be attached to specified manual models. Once started, titrations finish themselves without the presence of an operator. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **16** *on Reply Card*

Free Trade Literature

Catalytic Gas Purifiers

. . . for trace removal of oxygen or carbon monoxide from hydrogen, nitrogen, argon, neon, carbon dioxide, or saturated hydrocarbons by reaction with hydrogen, or carbon monoxide; bulletin on "Deoxo" gas purifiers gives reactions, uses, and operation for 5 types. Baker & Co., Inc., 113 Astor St., Newark 5, N.J.

Circle No. **17** *on Reply Card*

New Bubble Tray Design

. . . for distillation columns features simplicity and removability; *Bulletin 10-M* gives background, mechanical and process features, with chart for estimating the approximate cost for "Uniflex" trays. Badger Manufacturing Co., 230 Bent St., Cambridge 41, Mass.

Circle No. **18** *on Reply Card*

TO POSITION DAMPERS, SLIDE VALVES and other control means →

ASKANIA
PNEU-DRAULIC VALVE POSITIONER

The Askania Pneu-Draulic Valve Positioner combines the advantages of both pneumatic and hydraulic control systems. It provides an air signal proportional to valve position, yet has incompressible fluid working at the heart of the unit.

Almost unlimited power can be smoothly and instantly applied with these positioners. For every increment of input signal between 3 and 15 p.s.i., the cylinder position finds a specific position within 1% of full cylinder stroke.

These positioners are rugged enough to withstand almost any abuse, because the signal amplifier has only one moving part—the well protected jet pipe.

Write for bulletin No. 1—86

ASKANIA REGULATOR COMPANY
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Subsidiary of General Precision Equipment Corp.

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A series of 8 articles by Cornelius E. Shannahan, instrument engineer with M. W. Kellogg Co., dealing with the four basic refinery instruments (pressure, temperature, flow, level), plus sections on controllers, control valves and pneumatic transmission—40 pages, 8¼ x 11¼, paper bound (1951-2) $1.00

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41 working-scale charts (21 equilibrium constant charts for the hydrocarbons from methane to 700°F. boiling point, and 20 activity coefficient charts), plus a description of how to use them—48 pages, 8½ x 11, paper bound (1949) . . $1.50

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replace cyclones and electrostatic precipitators and offer

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PALL
The Pall Filtration Companies
Micro Metallic Corporation | Porous Plastic Filter Company | Aircraft Porous Media, Inc.

Liquid Level Gages

. . . for remote reading; *Catalog No. 246* describes gages, design features, operation schematics, typical applications, and performance data. Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.

Circle No. **19** *on Reply Card*

Cast Stainless Alloy Data

. . . compilation of 13 data sheets describing each of the cast corrosion resistant alloy grades; the *ACI Data Sheets* list chemical compositions, physical and mechanical properties, design considerations, metallurgical structures and characteristics, preferred heat treatments, fields of application, and corrosives with which each grade has been successfully employed. Alloy Casting Institute, 32 Third Ave., Mineola, N.Y.

Circle No. **20** *on Reply Card*

"Alamask"

offers a complete and diversified line of reodorants for petroleum and allied products

No longer need the products of the petroleum industry inflict upon their users the obnoxious odors resulting from the mercaptans and sulfides in their processing.

Years of development work and product-testing have culminated in a complete line of Alamask® reodorants that can successfully mask the objectionable odors of many petroleum products. Check this table to see which Alamask reodorants will solve your malodor problems:

"ALAMASK"	GASOLINE FRACTIONS	ASPHALTIC COMPOUNDS	KEROSENE BLENDS	COAL SPRAY OILS	SPACE HEATERS	CUTTING OILS	CLUTCH OILS	DIESEL FUELS	JET FLUIDS	MINERAL SPIRITS	WAXES	NAPHTHA	BURNER OILS
AAM								X					
AO						X	X						
AR		X								X			
BGM		X											
BN						X	X						X
BUL				X	X			X			X		X
CC			X							X			
CE			X							X			
CX											X		
MS			X							X	X	X	X
0.19	X				X	X	X		X				X
0.20	X				X	X	X		X				X
TO									X				

Rhodia's chemists and engineers, experienced in odor abatement and waste disposal, will provide technical assistance to you in your efforts to correct malodors.

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Selective Infrared Analyzer

. . . for continuous recording of a quantitative analysis for single components in gas or liquid streams; I.D.S. 10.16-7b describes application to automatic process control for blending, synthesis, separation, and cost accounting and describes method of operation. Minneapolis - Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **21** *on Reply Card*

Controlled Volume Pumps

. . . in process instrumentation as flow controllers, ratio controllers, and final control elements; *Bulletin 1253* describes various controlled volume pumps available and typical applications in chemical, petroleum, and other industries. Milton Roy Co., Station Y, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Circle No. **22** *on Reply Card*

Aerosol and Smoke Photometer

. . . for measurement, and control of air pollution and particulate matter suspended in aerosols; *Bulletin JM-1000-A* describes photometer design and operation, lists other applications for control, research, and testing, and lists accessories available to extend instrument's usefulness. Phoenix Precision Instrument Co., 3803-05 N. 5th St., Philadelphia 40, Pa.

Circle No. **23** *on Reply Card*

Water Jet Eductors

. . . for handling liquids, slurries, and solids in the process industries; *Bulletin 2-M* gives information on design, construction, application and operation of eductors which are widely used for lifting, pumping, mixing and agitating. Schutte and Koerting Co., Dept. J-M, Cornwells Heights, Bucks County, Pa.

Circle No. **24** *on Reply Card*

Universal Recording Balance

. . . designed for the observation and recording of small, rapidly changing forces with respect to time; *Bulletin 103* describes functioning and principle of operation and twelve important uses including observation of evaporation, absorption, specific gravity and others. The Sharples Corp. Research Laboratories, 424 W. 4th St., Bridgeport, Pa.

Circle No. **25** *on Reply Card*

What's New!

Plug-Mounted Relays

. . . for industrial applications; *Circulars 1801-1805* for Classes A, B, F, S, and Z relays give dimensional drawings, wiring diagrams, and specifications. Automatic Electric Sales Corp., 1033 W. Van Buren St., Chicago 7, Ill.

Circle No. **26** *on Reply Card*

Neoprene Rubber

. . . for tank coatings and other industrial uses; *Neoprene Notebook No. 60* describes chemical tank coating giving cost studies, the testing of rubber products, hog drive belts, and safety shoes. Rubber Chemicals Div., E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Del.

Circle No. **27** *on Reply Card*

Chemical Respirator

. . . giving protection in areas contaminated by light concentrations of organic vapors, acid gases, ammonia, dusts, mists, fumes, and smokes; *Bulletin No. 1007-5* gives description and illustration of the respirator. Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

Circle No. **28** *on Reply Card*

Castable Refractories

. . . for high temperature service applied by spray gun to refinery heating and conversion equipment; brochure shows how castable refractory linings are applied, gives equipment applications and physical and operational specifications for 12 types of castables. Mexico Refractories Co., Mexico, Mo.

Circle No. **29** *on Reply Card*

Laboratory Balances

. . . with a claimed ±0.002 milligram accuracy of the single-pan constant-sensitivity type; *Bulletin No. FS-207* gives the theory and operation for the standard, semi-micro, and micro "Gram-atic" balances. Fisher Scientific, 717 Forbes St., Pittsburgh 19, Pa.

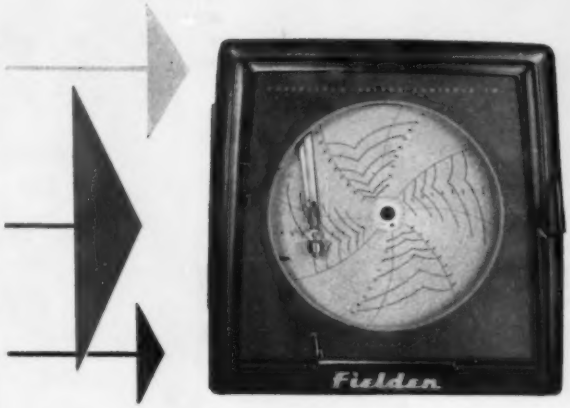
Circle No. **30** *on Reply Card*

Synthetic Chemicals

. . . including resins, pentaerythritol, plasticizers, and nonionics listed in technical booklet which has descriptions and physical and chemical properties. Hercules Powder Co., Wilmington, Del.

Circle No. **31** *on Reply Card*

must a well engineered chart recorder be expensive?



fielden says, "no!"—when you can install a MULTIPOINT Recorder with up to 48 or 96 separate points—with each point available at a cost unheard of before!

Reason: Simplified design, circuitry, and construction. The chart mechanism is rugged, but so simple in form that there is little or no maintenance throughout the life of the instrument. Yet it's *accurate*—to ±½% of full scale, with a sensitivity of 0.1% and reproducibility of ±0.5%. Fielden furnishes 3 types of Multipoint Recorders: TEKTOLOG electrical quantity for pH, thermocouple and tachometry; A.C. NULL BALANCER for resistance temperature and conductivity measurements; and D.C. NULL BALANCER.

Does simplified, low cost—and reliable instrumentation appeal to you? Then use the coupon below today for full details.

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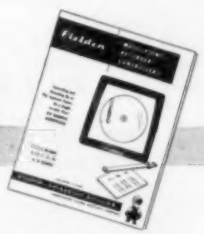

FIELDEN INSTRUMENT DIVISION
2920 N. 4th St., Dept. K, Philadelphia 33, Pa.
Send full details on the Fielden Multipoint Recorders checked below.
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Each Kel-F lined rupture disc is given a leak detector test and must be proven pin-hole free.

The large stock of controlled ductile metals used in the manufacture of BS&B rupture discs enables us to duplicate a previous requirement as well as affording you a wide selection in pressures — from 5 to 50,000 lbs.

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Whenever BS&B Safety Heads are installed in a location where corrosive conditions exist, an unprotected metal rupture disc may be vulnerable to corrosive attack from either the product or the atmospheric side—or both.

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The use of Kel-F linings in combination with metals of known mechanical and metallurgical qualities such as Inconel, Monel, stainless steel and nickel means positive, trouble-free protection in highly corrosive applications heretofore impossible.

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For full information on the BS&B Kel-F lined rupture disc and its application to your specific problem, consult your BS&B Office or Representative . . . or write to us direct.

THE "CIRCUIT-BREAKER" OF *Any Pressured System*

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EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

What's New!

Ultra Violet Black Light

. . . and its applications to medicine, science, and industry; *Ultra Violet Black Light, the Newest Medium of Science* includes charts, data and information on present and potential uses, with a listing of equipment and prices. Burton Manufacturing Co., 11201 W. Pico Blvd., Los Angeles 64, Calif.

Circle No. **32** *on Reply Card*

Filter For Wet Corrosive Gases

. . . and air removes dust, dirt and impurities by passing gases horizontally through two or more cells containing moving granules; *Bulletin No. 4* gives principles, installation examples, descriptive data, and engineering drawings of filter components and complete systems. Mechanical Industries, Inc., 939 Grogan Building, Pittsburgh 22, Pa.

Circle No. **33** *on Reply Card*

New Proportioning Pump

. . . has high speed valves and uses no packing; *Bulletin AP-54* gives drawing and performance and operating data for pulse free metering of small quantities of fluids up to 2500 psi-10,000 psi by special construction—with pump having output flow range of 35:1. Hills-McCanna Co., 3025 N. Western Ave., Chicago 18, Ill.

Circle No. **34** *on Reply Card*

Vertical Encased Pumps

. . . with close coupling for process and transfer applications; *Hydro-Line Pumps* bulletin gives characteristics and applications for use with hydrocarbons and mildly corrosive liquids, with capacities to 3000 gpm, head to 1000 ft., and temperatures to 400° F. Peerless Pump Div., Food Machinery and Chemical Corp., 301 W. Ave. 26, Los Angeles 31, Calif.

Circle No. **35** *on Reply Card*

Pressure Vessel Codes

. . . compared on an over-all basis in a new 1954 supplement is the subject of a feature article by Walter Samans in the Fall, 1954 issue of *Alco Products Review*, continuing a discussion first published in the Spring, 1953, issue. Another article discusses Continental Oil Co.'s enlarged Lake Charles, La., refinery. American Locomotive Co., Schenectady 5, N. Y.

Circle No. **36** *on Reply Card*

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SUPERIOR CRAFTSMANSHIP

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A.S.M.E. CODE

CHEMICAL PROCESSING EQUIPMENT FOR PILOT PLANT OR PRODUCTION

FABRICATORS OF
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Flexible facilities accommodate individual designs for pilot plant or production. Equipment built in a variety of sizes and finishes to your exact requirements.

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For over half a century Cream City Boiler Company has been a recognized leader in the fabricating field. Today our experienced craftsmen and versatile methods give you more dependable, economical, high quality equipment — as you want it — when you want it.

Our engineers will assist you in the selection of the most economical design for your requirements.

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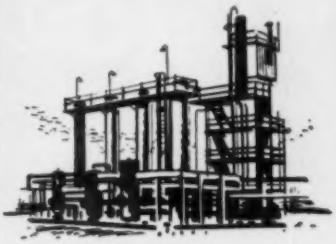
problem

To meet ethylene consumer demand for a product that is essentially free of acetylene.



solution

GIRDLER developed catalysts to selectively hydrogenate the acetylene in the presence of the ethylene. Acetylene content was cut more than 99% giving consumers what they wanted:

Ethylene with less than 50ppm of Acetylene

Girdler will gladly help solve *your* catalyst problems.

FOR Catalysts

WRITE...

The GIRDLER Company

A DIVISION OF
NATIONAL CYLINDER GAS COMPANY
Gas Processes Division
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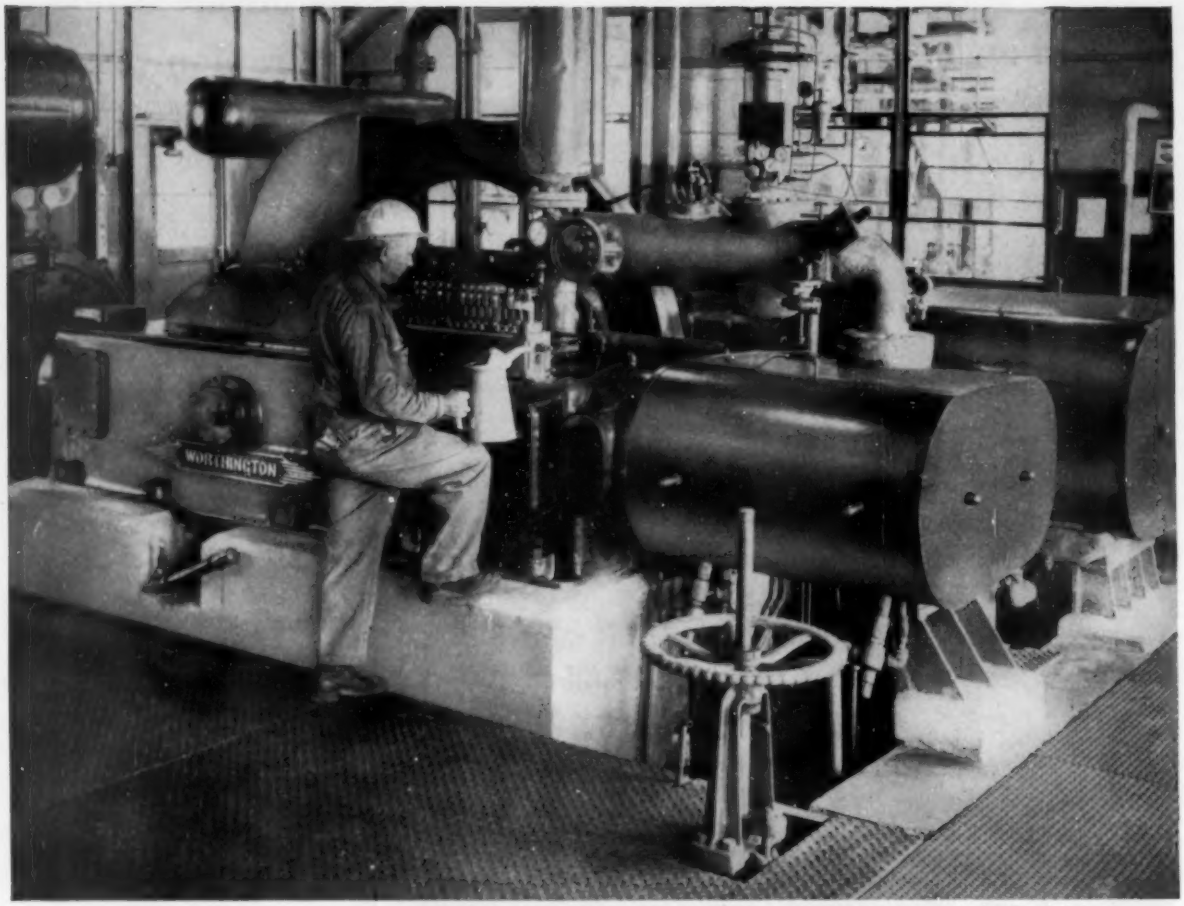

AVAILABLE STEAM DRIVES THIS WORTHINGTON COMPRESSOR at the Rock Island Refining Company in Indianapolis. Part of the hydrocarbon gas being compressed is taken off between compression stages and used to move a catalyst from storage.

Power failure won't stop this compressor

It's a Worthington *steam-driven* compressor which supplements a motor-driven compressor at the Rock Island Refining Company's plant in Indianapolis.

Here's the way Rock Island works it: the motor-driven machine (also a Worthington) is operated as a base load unit. The steam-driven compressor floats on the line, handling any swings in capacity by an increase or decrease in speed. And it's easy to vary the speed — and hence the capacity — by simply turning hand-wheels which control the amount of steam admitted to the compressor. If electrical power fails, the steam-driven unit can take over the entire compression job almost immediately. Result — process keeps going.

Five years of almost continuous operation have shown that the addition of the steam-driven Worthington was a wise move. One of the many features responsible for the fine performance record of this sturdy compressor is the exclusive Worthington Feather* Valve — the lightest, tightest, most efficient valve made. It's standard equipment on every Worthington compressor.

We'd like to help with your compressor problem, too. Write us. Worthington Corporation, Water Cooled Compressor Division, Section K.3.6, Buffalo, N.Y.

**Reg. U.S. Pat. Off.* K.3.6

WORTHINGTON

Only Worthington Compressors Give You Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

Catalyst Research

. . . and other phases of surface chemistry and related studies; bulletin describes facilities for solving problems pertaining to catalyst selection, reaction mechanisms, adhesion, adsorption, corrosion, lubrication, ion exchange, and others. Battelle Memorial Institute, Columbus 1, Ohio.

Circle No. **37** *on Reply Card*

Choosing the Right Valve

. . . type for the right job with bulletin *AD 2016-75M;* correlates valve types with service requirements and working details of pressure, temperature, fluid, flow rate, and other operating and physical conditions. Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Circle No. **38** *on Reply Card*

Pressure Filters

. . . for the removal of suspended solids such as dirt, turbidity, iron, oil and color; *Bulletin No. 2225B* gives design and construction features, dimensions, specifications, and applicable accessories. The Permutit Co., 330 W. 42nd St., New York 36, N.Y.

Circle No. **39** *on Reply Card*

Shell & Tube Heat Exchanger

. . . for the process industries; *Catalog No. 1254* gives materials, construction details, dimension drawings, specifications, and data for exchanger selection for water-to-water and water-to-oil heat transfer. Young Radiator Co., Racine, Wisconsin.

Circle No. **40** *on Reply Card*

Strainers and Relief Valves

. . . to protect process equipment; *Catalog 12-T* gives ratings, specifications, and tips on installation and maintenance. Edward Valves, Inc., 1201 W. 145th St., East Chicago, Ind.

Circle No. **41** *on Reply Card*

Flexible Lining Material

. . . for tanks, fume ducts, tank cars, trucks, and equipment handling corrosives during mixing, storing, washing, and transporting; *Facts You Should Have on Vyflex L-10* and *Bulletin L-10* describe polyvinyl chloride base thermoplastic coating which resists the action of common acids, alkalis, salts, plating solutions, organic compounds, and oxidizing acids up to about 160° F, and which can be applied without curing to steel, wood, or concrete. Available on letterhead request from Kaylor Industries, Inc., Yardville, N.J.

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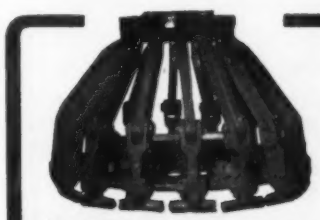

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for handling greases and other viscous fluids.
- No operator required.
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Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

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FLINT STEEL CORPORATION is a 40-year old firm, but we're still youthful in our outlook and ability to get things done. We retain our youth by keeping up with all the latest developments in steel plate fabricating with modern equipment. And, we've been fabricating specialized TULSA TYPE equipment for the petroleum and petrochemical industries for 30 years. This combination of long experience and modern machines goes to work for you whenever you call on FLINT STEEL. We earnestly invite you to discuss your plate fabricating problems with us at any time.

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TULSA, OKLAHOMA

LPG Valves

. . . for distribution manifolds, pump lines, bulk plant manifolds, and storage tank loading lines; *Bulletin 54-S* gives specifications, dimensions and descriptions. Okadee Co., 332 S. Michigan Ave., Chicago 4, Ill.

Circle No. **42** *on Reply Card*

Industrial Growth Trends

. . . in the chemical, plastics, and fertilizer industries; *Technology Behind Investment* estimates future prospects with reference to raw materials, processes, competition, markets, and prices. Arthur D. Little, Inc., 30 Memorial Drive, Cambridge 42, Mass.

Circle No. **43** *on Reply Card*

Steel Plate Storage Tanks

. . . of cone roof, floating roof, irregular shaped, underground and other types for petroleum and chemical storage; *Catalog 54B* gives material specifications, design data, foundation recommendations, welding procedures, testing methods, and computing tables for size and capacity with illustrated examples of applications. Hammond Iron Works, 630 Fifth Ave., New York 20, N.Y.

Circle No. **44** *on Reply Card*

Instrument Air Cleaner

. . . continuously removes petroleum vapors, dirt and liquids from air and gases by absorption; *Bulletin SC-1047* gives description, operation principles, and dimensions for units with capacities from 100 to 2500 cfm. Selas Corp. of America, Erie Ave. and D St., Philadelphia 34, Pa.

Circle No. **45** *on Reply Card*

Steam Cleaning Gun

. . . for cleaning and paint stripping of machinery and equipment is lightweight and requires no booster pump, motor or tank; bulletin lists uses, operation, specifications and prices. Equipment Div., Magnus Chemical Co., Inc., Garwood, N.J.

Circle No. **46** *on Reply Card*

Streamlined Boiler Baffles

. . . designed for improved flow of combustion gases over the heat-absorbing surfaces; *Bulletin BW 54* illustrates baffling of tubes for more than thirty boiler-setting plans, construction precautions, and design principles for both new and old boilers. The Engineer Co., 75 West Street, New York 6, N.Y.

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Control Valves

. . . including 4-way hand, foot, power and solenoid types listed in *Bulletin 1010*, which gives dimensions, weights, application diagrams, circuit diagrams and parts and accessories lists. Ledeen Manufacturing Co., 1600 S. San Pedro St., Los Angeles 15, Calif.

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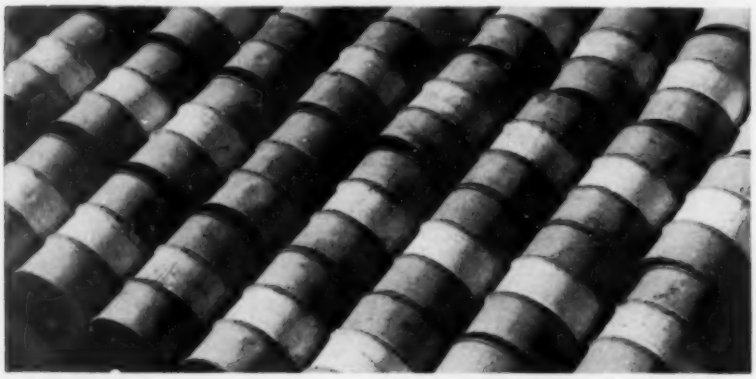
Process Line Repair

. . . by covering weak or eroded areas with polyester resins and glass cloth described in *Celanese Plastics*, Vol. 12, No. 9, Sept. 1954. Celanese Corp. of America, 180 Madison Ave., New York 16, N.Y.

Circle No. **49** *on Reply Card*



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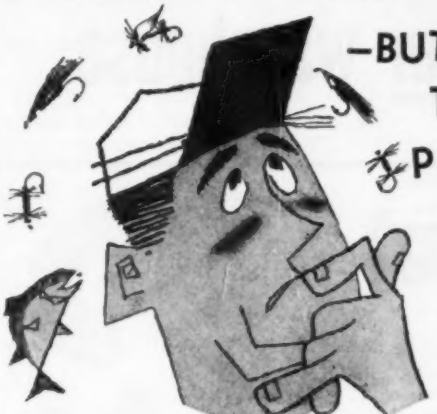

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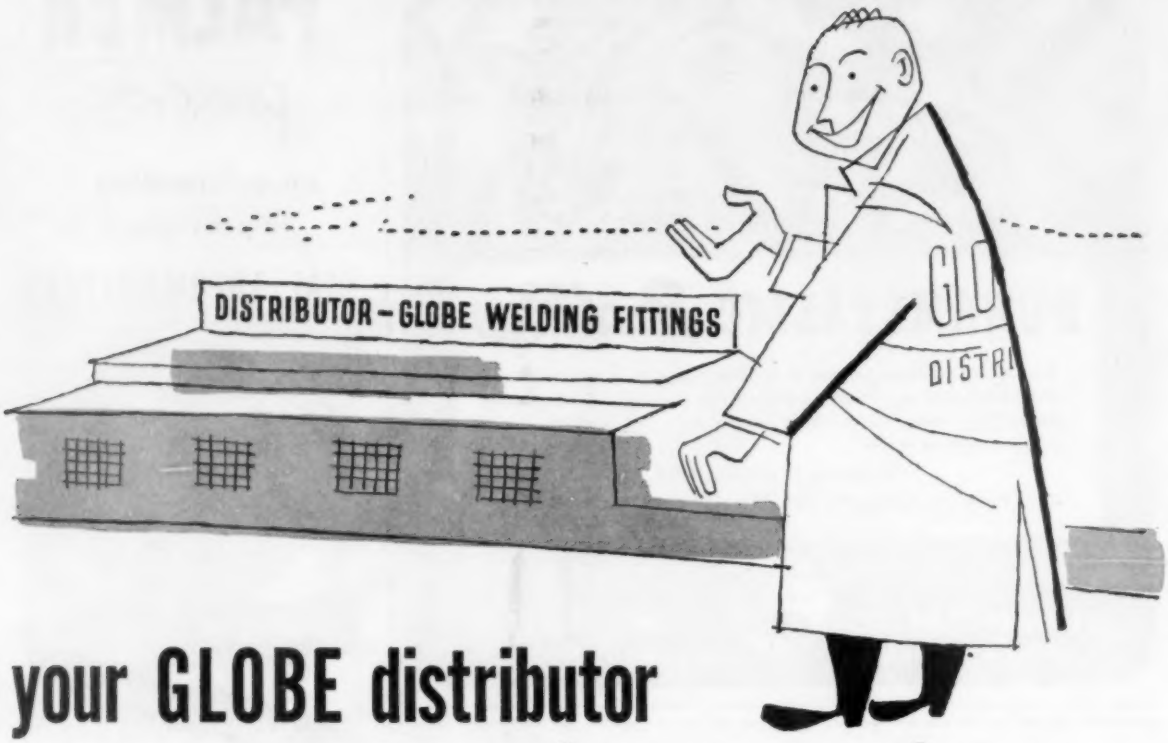

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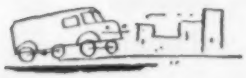

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. . . for high capacities in the high vacuum range; bulletin gives ranges, characteristics, curves, physical and operating specifications, and applications. Naresco Equipment Corp., 160 Charlemont St., Newton Highlands 61, Mass.

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Temperature Alarm System

. . . serves 12 points independently with one temperature indicator; *Publication No. 3036* describes automatic monitoring alarm system having range of —60° to +1350° F, and gives dimensions and specifications. Thomas A. Edison Inc., Instrument Div., West Orange, N.J.

Circle No. **51** *on Reply Card*

Cathodic Corrosion Protection

. . . using graphite anodes; *Catalog Section S-6500* gives advantages of graphite, where to use cathodic protection, how to install anodes, ground resistance curves, and the design and drawing of a typical ground bed. National Carbon Co., 30 E. 42nd St., New York 17, N.Y.

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. . . both inside and outside surfaces, for storage of neutral products where non-contamination, cleaning ease, and product non-adhesion are important; *Bulletin 916* gives specifications, dimensions for capacities of 1000 to 5000 gal., and materials which can be stored in glass lined tanks at room temperature. The Pfaudler Co., Rochester 3, N.Y.

Circle No. **53** *on Reply Card*

Catalytic Action Study

. . . with electron diffraction instrument; *Pub. 8A-3566* describes uses, specifications, and principles. General Electric, X-Ray Dept., Milwaukee 1, Wisc.

Circle No. **54** *on Reply Card*

Horizontal Propeller Pumps

. . . for mixed and axial flow operation for process industries; *Form 7280* gives dimensions and specifications for pressures to 25 psi and capacities to 16,000 gpm. Ingersoll-Rand Co., 11 Bdwy., New York 4, N.Y.

Circle No. **55** *on Reply Card*

Di- and Tri-ethylene Glycol

. . . physical data and list of uses as humectant, liquid desiccant, foundry sand mix, and for explosives given in bulletin *F-8085*. Carbide and Carbon Chemicals Co., 30 E. 42nd St., N. Y.

Circle No. **56** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of Petroleum Processing to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.

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Circle No. **57** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in August, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

Simple Design Feature of New Flowmeter for Steam, Gases

. . . where high accuracy and stability of operation are desired. The King "Critiflo-Meter" can be used for measurement and control of the flow of steam and other gases in petroleum, petrochemical, and similar industries; for steam proportioning, and so on. It consists of two simple parts: 1) a housing containing a nozzle made from chrome carbide or hardened stainless steel, and 2) a flow indicator connected to the housing. The instrument needs little maintenance and can be readily installed in any piping system. Housings are available in pipe sizes from 2 to 10 in. inclusive, for pressures up to 900 psi., and flow rates ranging as high as 300,000 lb./hr. of dry and saturated steam. The meter operates under any condition where the ratio of absolute pressure upstream (in the housing) is equal to, or less than, the so-called critical pressure ratio for the fluid measured. Under this condition, the fluid moves through the nozzle throat at sonic velocity—neither more nor less; and variations in downstream pressure have no effect on the rate of flow, so long as the critical pressure ratio is not exceeded. Thus, weight flow is directly proportional to upstream pressure, and a simple gage measuring only this pressure can be used to measure flow rate. Accuracy of the readings depends solely on the accuracy of the indicator or recorder used. King Engrg. Corp., Ann Arbor, Mich.

Circle No. **58** *on Reply Card*

Shaft Seal Can Be Replaced Quickly on Split-case Pumps

. . . in the event of seal failure. The new "John Crane" Type 9 mechanical

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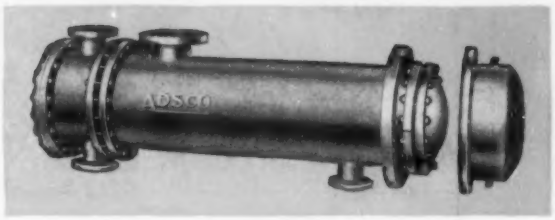

A type of ADSCO heat exchanger widely used in industrial plants is the float-head, split-ring heat exchanger shown above. It is used for heating, cooling, or condensing, or for a combination of these. Shells can be of steel or a non-ferrous metal with either steel or non-ferrous tube sheets. Tubes of the removable tube bundle vary in size from ⅝" O. D. to 1¼" O. D. The pitch can be square or rectangular, depending on the fouling conditions and cleaning requirements. ADSCO heat exchangers are manufactured in conformity with ASME code for unfired pressure vessels.

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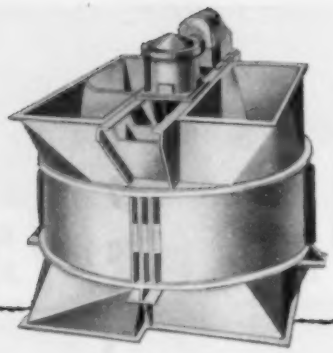

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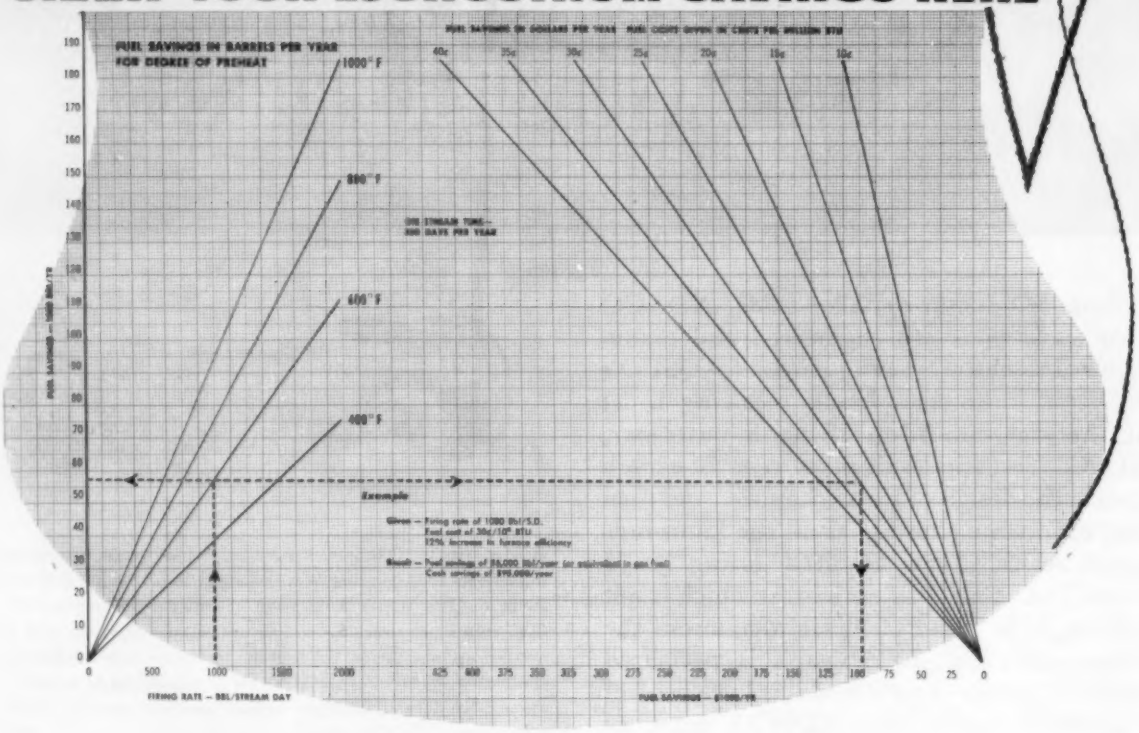

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shaft seal is mounted on a sleeve with an outside clamping ring. This type of arrangement permits fast installation and/or removal in practically all modern split-case centrifugals, in that it is not necessary to unbolt the top of the horizontal split shell. The seal can be used to handle virtually all corrosive liquids at temperatures up to 500° F. Flexible sealing members are made of chemically inert Teflon. Springs and metal parts can be furnished in the metallurgical specifications best suited to the service. Sizes are available to specification. According to performance data recently compiled, all cargo pumps of an East Coast oil tanker were equipped with a special adaptation of the Type 9 seal for service in 11 round-trip voyages between Philadelphia and Texas. On completion of the trips, inspection of all pumps showed there had been no leakage. Crane Packing Co., Dept. PPN, Chicago 13, Ill.

Circle No. **59** *on Reply Card*

Acrylonitrile Conversion Chart

. . . showing chemical methods for synthesizing more than 100 derivatives from acrylonitrile; wall chart, 44x34 in., has methods classified according to three main types of reactions: cyanoethylation, nitrile, and olefinic. Monsanto Chemical Co., St. Louis 4, Mo.

Circle No. **60** *on Reply Card*

The Ethanolamines

. . . mono, di, and triethanolamine; booklet gives properties, chemical performance, and pH values of the three compounds; contains vapor-liquid composition curves, as well as viscosities and total vapor pressures of solutions; lists properties of ethanolamine soaps; reviews uses of the compounds. Dow Chemical Co., 45 Rockefeller Plaza, New York City.

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Aluminum Welding

. . . and the latest developments in this field are fully covered in a new 176-page book, *Welding Alcoa Aluminum*, designed as a text and a practical manual; including data on selection of method, performance of welds, control of welding quality; and 32 comprehensive tables of data on properties of alloys, compositions, and strengths. Copies are available from Aluminum Co. of America, 733 Alcoa Bldg., Pittsburgh 19, Penna.

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No. 1* of . . .

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Next Steps in Atomic Progress . . . A Challenge to American Industry

The purpose of this editorial is to throw light on the significance for American industry of recent changes in the statutes that control the development of atomic energy.

The need for clear light on the meaning of this new legislation is made more urgent by the political confusion and distortion that marked its course through Congress. The politically inspired charges of "giveaway" that delayed its passage—charges that were almost totally unrelated to the legislation itself—helped to obscure the vital importance of the step finally taken by Congress.

In sober, post-Congressional fact, the principal significance of the new atomic legislation is that it extends to private enterprise responsibility for the development of peaceful uses of atomic energy, whereas heretofore this responsibility has rested in a tight government monopoly. **And this extension is made on terms that emphasize the responsibility far more than they open any opportunity for economic gain in fulfilling it.** The revised Atomic Energy Act provides that:

1. Industry may now own and operate its own nuclear reactors, under license from the Atomic Energy Commission. And it may build and sell nuclear reactors for export.

2. Industry may use—but not own—nuclear materials at the discretion of the Atomic Energy Commission.

3. The Atomic Energy Commission will make available to industry scientific knowledge that may be useful in developing peaceful applications of nuclear energy.

4. For the first time, industry will have the right to patent inventions in the field of nonmilitary nuclear energy. However, "basic" discoveries must be made available to all companies in the field for a period of five years, after which they, too, will revert to normal patent status.

Two Kinds of Know-How

These provisions, despite the imposed limitations, represent the first positive step toward development of nuclear energy for peaceful applications in the United States. Potentially useful knowledge, previously locked in the minds of government scientists, will now be available to all those who are willing and able to put it to work for the good of mankind.

The advantages to be gained from enlisting the talents of American industry in the development of peaceful atomic applications are imposing. As *The* (London) *Economist*, Europe's leading economic journal, recently remarked, "The atomic scientists are in a position to surmise how atomic energy can be applied... but they lack the specialized knowledge of engineering design and operating technique just as industry itself lacks atomic knowledge." Now the engineers of private industry need no longer lack the atomic knowledge, and there is granted to them at least a restricted freedom to apply it to the solution of their engineering and operating problems.

But the new opportunity for private industry to find constructive uses for the science of nucleonics carries with it a grave responsibility. These uses must be so developed that they will benefit the people of all the free nations. It is essential that the United States, which pioneered in developing lethal uses for atomic fission, demonstrate to the world our paramount interest in its peaceful application. It would be a moral set-back to the free world almost beyond calculation if the Communists should be able to offer to the poorer nations of the world the benefit of low cost atomic power—provided by Communist technicians—while we concentrate primarily on building our stockpile of atomic and hydrogen bombs.

Race For a Peaceful Victory

Most of the experts are agreed that it may be many years—perhaps ten, fifteen or more—before the cost of electricity from atomic fission can be reduced to a level that will make it competitive with conventionally produced power in most regions of the United States. But most of the world is not nearly so fortunate as we are in power resources. Electricity, even at a cost far higher than the average that prevails in the United States, would be a blessing in many countries, and the nation that provides the technology to bring it into being will score a great moral victory.

The useful potential of nuclear energy is not restricted to the generation of electric power—although twenty years from now this use will be highly important to the power industry of the United States. Even with the limited research that has been done in this field thus far, the use of radioisotopes—the radioactive products of atomic reactors—is saving American industry an estimated $100 million a year. Commissioner Campbell of the AEC, who made this estimate, believes that these savings may well reach $1 billion a year within ten years. Radioisotopes are already at work in industries ranging all the way from paper manufacturing, where they measure paper thickness, to pipeline transportation, where they mark the dividing lines between shipments of different products (at an estimated saving of $500,000 a year). Medical applications of these same radioisotopes hold promise of longer and more comfortable lives for those who are stricken by cancer and other diseases.

Above All a Challenge

The new Atomic Energy Act is a crucial stride toward the day when all these benefits—and undoubtedly others not yet revealed by research—will be realized. But it is a step that is essentially permissive. It still leaves it to private industry for the most part to decide what is to be done and how soon.

The new act is thus, above all, a challenge. It confers on private industry the responsibility to assume a leading role in the development of peaceful uses for nuclear energy, a step long urged by NUCLEONICS, a McGraw-Hill magazine devoted to atomic energy. To achieve a success in this task that will measure up to the requirement of the national interest, this development must command all the resources and ingenuity that private enterprise can apply—and do so without promise of glittering prizes surely to be won. **But now that the responsibility has been defined and the challenge offered, American industry will, we believe, measure up to its grave and mighty import.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

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EDITORIALS . . .

Are You Just WATCHING the Atoms?

IT SEEMS to us that the petroleum processing industry is being a little slow in awakening to the full possibilities of how atomic energy can be of use in industry. We make this observation after studying the technical programs for two recent meetings on the subject—and noting the decided absence of representatives of the petroleum industry.

At the International Congress on Nuclear Engineering held at the U. of Michigan last June there were nearly 100 technical papers—but only one of them was by oil company technologists.

At the National Industrial Conference Board's third annual conference on Atomic Energy in Industry, held in New York City last month, there were a series of 13 technical sessions, and the program included about 60 technical representatives from private industrial, research and educational organizations—but only two of them were from oil companies.

Let's make it clear that we're not talking about atomic power as a competitor to petroleum as an energy source. That's a long-range, crystal-ball proposition at present.

We're talking about the application of radioactive materials to current industrial operations—for tracing, for catalyzing, for measuring. We're talking about the use of radioactive materials as industrial tools. There has been a little such work, but only a very little. In fact, we were astonished to learn that the petroleum research laboratory which we consider to be the largest and most progressive in the country set up its first radioisotope laboratory only within the past year.

Sit on the sidelines and watch the General Electrics and the Monsantos work with the atom if you want to, men, but if you continue to do so much longer you may still be watching when the parade goes by.

Statistics, Hot or Cold?

THE reorganization of the work of the U. S. Bureau of Mines, which was recommended this summer by an outside survey team appointed by Assistant Secretary of the Interior for Mineral Resources Felix Wormser, contained several cogent suggestions for improving the Bureau's petroleum and natural gas activities.

One basic recommendation was that "there be a coordinated strengthening of all statistical and commodity analysis work." In this connection, it is hoped that the matter of expediting the issuance of petroleum industry statistics is being emphasized.

The Bureau's present reports give good coverage of important data and they are accepted generally by the industry as authoritative. Their usefulness suffers because of the long delay in placing the information in the hands of the oil companies. There is a lag sometimes of more than two months between the collection of the statistics given in the Bureau's *Monthly Petroleum Statement* and the time it is placed in the refiners' hands. The more detailed data on product manufacture and distribution given in the *Minerals Yearbook* is delayed even longer. Figures for 1952 have just become available.

The American Petroleum Institute partly meets the lack of current statistics through its weekly report on refinery operations. This is good as far as it goes, but it lacks the detail of the Bureau's monthly report. PETROLEUM PROCESSING, in its "Trends" section, also helps to span the gap by publishing a correlation of the earlier Bureau reports on product supply, demand, and stocks with the current API reports.

The Bureau staff places a part—at least—of the blame for this delay on the tardiness of the refining companies in getting their own individual monthly reports in and on the lack of cooperation from other government agencies.

That these are minor in relationship to inefficiencies within the Bureau seems evident in the survey team's report. Pointing out that over $1,000,000 a year is spent on data collection, analysis, and allied functions, the report recommends that this work of the Bureau be unified under competent direction and that statistical processing activities be centralized, for "more timely publication of statistical data."

In the case of information on which an industry must largely depend to guide its operations, promptness in reporting is as important as accuracy of the data presented. Cold statistics may do for historical purposes; but, like all news, they must be "hot" to be of maximum use to the refiner in his planning.

John Day—A Constructive Leader

IT WAS no easy task that confronted John C. Day when he became secretary-treasurer of the Western Petroleum Refiners Association in 1939.

Just the year before, several of his member companies and their officers had experienced the worries and troubles of defending themselves in a suit brought by the government charging a conspiracy to fix wholesale gasoline prices. Happily, after a long trial, the suit ended in minor fines against a few individuals. However, the refining companies were wary of any kind of joint activity, regardless of its nature.

Faced by this situation, John Day, who had an engineer's training and a few years' experience as a technologist for WPRA before he took the higher position, guided his members into studies of some of their common technological problems. Good technical speakers were brought to his meetings. The association sponsored research in fields where refiners generally could enjoy the benefits. District meetings were scheduled for the benefit of plant operators who could not attend the general meetings. Every effort was made to broaden the association's work and make it of value to the petroleum refiners generally.

The progress the Western Petroleum Refiners Association has made in the past 15 years and its standing today among the oil industry associations will always remain a tribute to the work and interest of John C. Day, who died recently in Tulsa.

BENEFITS You can get with SULFAN®

(Stabilized Sulfuric Anhydride)

for Sulfonated Lube Oil Additives

and other

Emulsifying and Demulsifying Agents

BENEFIT No. 1 **Increase Yields**

Because of the extremely reactive nature of SULFAN, higher molecular weight compounds can be sulfonated to produce desirable oil soluble sulfonates. Treatment with Sulfuric Acid or 20% Oleum leaves these compounds unreacted.

BENEFIT No. 2 **Eliminate Waste Acid Problem**

Since water is not formed when SULFAN is used for sulfonation, the waste acid problem inherent in using Sulfuric Acid or Oleum is eliminated.

BENEFIT No. 3 **Improve Sulfonation Efficiency**

SULFAN has 99.5% SO_3 available for sulfonation reactions; thus, for many applications SULFAN offers nine times as much usable SO_3 as 100% Sulfuric Acid and over three times as much as 20% Oleum. This can mean a considerable saving in sulfonation costs.

BENEFIT No. 4 **Step Up Processing Efficiency**

The absence of waste acid when using SULFAN permits larger batch sizes or more rapid through-put in a sulfonation process. This means that by using SULFAN, batch size or through-put can be doubled or tripled without increasing the size of the equipment.

Tank Car Quantities

A laboratory development just a few short years ago, SULFAN today is a commercial chemical of ever-growing importance. This new processing tool is now being regularly shipped to many users in tank car quantities. For technical data on SULFAN, experimental quantities, or other assistance, contact any General Chemical office listed below.

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For American Industry

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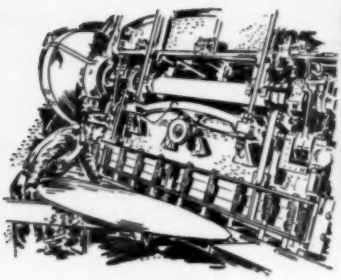
THERE IS ALWAYS TOMORROW



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